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PROBLEMS OF TRANSPORTATION.

DURING the past seven days the question of transport conditions in this country has been brought prominently before the public by three independent events: the Annual Congress of the Tramways and Light Railways Association, last Friday, the publication of the Report of the House of Commons Select Committee on London Traffic, and the debate on the Transport Bill in the House of Lords. With the last-named item we have little to do on this occasion, but the conjunction of these events, in view of the circumstances attending them, is significant of the exceedingly serious situation which now prevails throughout the whole country, as the result of the changes brought about by the war.

The Transport Bill arises out of the impossible position at which the great arteries of communication have arrived, owing to the cost of labour and materials and the congestion of traffic; the report of the Select Committee reflects the intolerable conditions of passenger transport in the Metropolitan area, due to similar causes; and the proceedings at the Tramway Congress reveal the difficulties and dangers which beset the tramway undertakings in all parts of the country by reason of the burdens under which they labour, and the restrictions by which their managers are bound. It is clear that action on the part of the Government is urgently necessary in order to place all these matters on a satisfactory basis, and to ensure the provision, in the interests of the whole nation, of adequate transportation facilities on sound financial lines.

The report of the Select Committee adds one more to the long series of inquiries which have been made, and reports which have been submitted to various Governments, and hitherto consistently ignored by all of them; we hope that now, at last, the problem of London traffic will be seriously taken in hand. The appointment of a Supreme Traffic Board for Greater London, which is the main recommendation of the Committee, has been called for again and again, and if it was pressing for attention before the war, it is vastly more urgently needed now. By no other means can we hope to mitigate the defects of the unsystematic provision which has been made by numerous independent bodies for dealing with the London passenger traffic, or to organise out of the disconnected elements some sort of homogeneous and efficient scheme. The Committee suggests that the Traffic Board shall consist of five members—apparently some magic resides in that number—in whom shall vest all the powers now possessed by existing authorities or conferable by statute; and the Board is to have executive authority, its functions being to deal with all transport questions in the public interest. Why has nothing been done in the past, in spite of the admirable and exhaustive reports which have been drawn up? Simply because there was no such authority; owners of vested

interests, jealous local authorities, and other bodies have succeeded in blocking the path of reform. The Committee fully realises this fact and emphasises it as the root cause of the "public scandal" which has now developed. Wisely it rejects any method of direct representation of the parties interested, and recommends a Board too small to waste time in interminable debate, yet large enough to ensure the adequate consideration of all problems from different points of view.

We cannot here discuss the many points dealt with in the report; the appointment of the Traffic Board is the supreme necessity, without which nothing can be effected, and, once that is accomplished, the remaining recommendations of the Committee will be dealt with in due course; but we gladly compliment the Committee on the production of a report so illuminating, so incisive, and so sagacious that we cannot doubt that action will follow—may it be soon!

Turning to the Tramway Congress, the keynote of the meeting, struck by the author of the first paper, Mr. W. L. Madgen, was the question of fares. In view of the general depreciation of the currency to less than half its pre-war purchasing value, it must be admitted that even with a 50 per cent. increase of fares, the travelling public is at present receiving an extremely cheap service, and the natural consequence is that the tramway undertakings are facing a position fraught with peril to their financial stability. We wish again to emphasise that 2d. to-day is hardly worth a pre-war penny—the fact is incontrovertible. Labour and materials—when they can be got at all—are costing the tramway authorities at least twice as much as they did five years ago, and yet the fares are limited by statute to maxima fixed before the war. It is true that if a sufficiently convincing case can be made out, some measure of relief is obtainable from the Board of Trade; but the Board undoubtedly looks with disfavour on any such proposition, with the result that the tramways are being starved. Their renewal funds, calculated on the basis of 1d. per car-mile, which used to be adequate, are now, of course, found to fall far short of the requirements of the present day; and though the extraordinary increase in the number of passengers carried per car-mile run has helped to reduce the disparity—incidentally stiffening the opposition of the Board of Trade to any increase in fares—the time is approaching when many undertakings will be compelled to run at a loss or to stop running altogether.

In his paper, which is abstracted elsewhere in this issue, Mr. Madgen divided the working costs into standing charges (the allusion is not to "strap-hanging") and running costs, and showed that, taking the aggregate returns of the Board of Trade for 1913-14 as a basis, the standing charge which should be recovered from every passenger before he travels a yard, amounts at least to ¾d. Hence the old rate of one penny per mile is quite inadequate to meet the requirements; as the running cost per mile is about ½d., the minimum charge should be at least 1¼d. As the public will not tolerate odd farthings, the only ways to deal with the case are either to charge 1½d. for the first mile, and ½d. per mile afterwards, or to adopt decimal coinage and charge a five-mil piece (1·2d.) for the first mile. At present the short-distance passenger is practically let off scot free, while the long-distance passenger bears the whole burden of increased fares—a gross injustice, and a system which is contrary to public policy, for the long-distance passenger should be encouraged to live on the outskirts of a town. In Glasgow, where ½d. fares have so long been in vogue—with striking success from the financial point of view—the tramways have done little to spread the population, which largely lives in flats of one or two rooms in many-storeyed "closes" in the central area, a condition which does not make for the cultivation of an "A1" standard of well-being. Glasgow, in fact, is essentially a "C3" city. At Manchester, on the other hand, the fares have been adjusted to encourage long journeys, with remarkable results in the spreading of the population.

The Select Committee considered that "while some increases of fares were inevitable, these are now in some cases far too high"; it went on to offer criticism in detail, but, we believe, in some cases on utterly wrong lines. However, we are pleased to see that it emphatically condemned the inequitable rating of tramways, and the iniquitous burdens laid upon them in respect of road maintenance and street improvements, and declared these impositions to be "indefensible." Tramway authorities, whether municipalities or companies, have long cried out against these oppressive burdens, to which we may add the duty of carrying workmen at less than cost price. These and many other grievances urgently demand attention—but first, above all, let us have the Traffic Board for London, and relief in the matter of fares for all the tramways in the country.

Far-Eastern Trade.

Engineering firms which have under consideration the problem of overseas markets, have of late often had their attention directed to China, and the endless possibilities of that undeveloped country. As some of our readers are aware, we have amongst us again Prof. Middleton Smith of the Hong Kong University, who is devoting the period of leave which is due to every Briton in China after a few years of service, to the task of persuading engineering firms to give China all of the blessings which follow the substitution of coal, oil, or water, as a source of energy in place of the human muscle. The thesis submitted is quite simple. It is this, China is changing; for a century Great Britain has had a paramount interest in the trade of China. But the demand of the future will be for metals and machinery, instead of, or in addition to, cotton goods from Lancashire. Will British engineers allow their trade rivals from other countries to beat them? We are quite confident that they will not, but we think it our duty to remind them, from time to time, of what is happening. For that reason we offer no excuse for quoting a few figures from the annual report on the foreign trade of China during 1918, which has been compiled by the Statistical Secretary of the Maritime Customs. "Notwithstanding the extraordinary and grievous drawbacks under which nearly all mercantile transactions had to labour," says the report, "the value of the direct foreign trade of China for 1918 was the highest on record."

We agree that this remarkable result "serves as an earnest of the development that may be looked for with the return of peace and normal conditions the world over." For the year under consideration the Customs revenue was about £1·3 millions more than in 1917. The sterling increase of trade was over £56·5 millions, the actual total for 1918 being £275,100,977. But whereas in 1914 the British and Japanese ratios of a total of over 19 millions of pieces of cotton goods were about 10 to 7, in 1918 the ratios were:—British, 2·6; Japanese 7 out of a total of 10·4 millions. But engineers will notice the words: "The cotton spinning industry in China has had another prosperous year, and additional mills will be erected as soon as the necessary machinery is available from abroad." An important point to note is that there has been a revision of the Customs tariffs for China, which it is expected will increase the revenue of that country. But this has been agreed upon by all of the Powers, and it has met with the approval of British merchants and officials. One interesting feature is that, in future, iron and steel (excepting tool steel) will pay the same duty. We have selected a few points from this annual report, because we are convinced that, even if British engineering firms cannot just now execute orders as rapidly as they would wish, they can be building up "good-will" in an almost untapped market amongst people who are suspicious of strangers but generous towards old friends. And the British, we are assured, as a nation, stand well in the eyes of the Chinese mercantile community. Let us cultivate them, and persuade them to purchase machinery.

AUXILIARY LIGHTING APPARATUS FOR USE IN ENGINEERING WORKSHOPS.

By J. BEAUMONT HARRISON.

It frequently happens that the ordinary lighting of engineering workshops, shipyards, &c., is not sufficient for all purposes, especially in places used for the construction of locomotives and railway carriages. In order to meet the requirements, portable electric lamps are used, the supply to the lamps being conveyed by means of flexible insulated cables. The consequence is that very considerable maintenance costs accrue as the flexible cables frequently become damaged, owing to the carelessness of operators using the lamps.

In large shops employing this method of lighting, as many as 800 or 900 connections may be used, and provision has to be made for a series of sockets, which are fixed on the walls or pillars of the shop. The sockets are often arranged in banks of from four to eight.

In the case of an engineering shop in the South of England, of moderate size, in order to meet the lighting requirements, upwards of 1,500 sockets have been provided.

Usually each bank of sockets is provided with a single-pole fuse to protect the circuit in case of a short-circuit arising in the portable apparatus. Unfortunately, a man often allows the flexible cable to be damaged in such a way that short-circuiting of the leads takes place, thus blowing the protecting fuse and putting that particular bank of sockets out of action, and most likely preventing a number of men from carrying on their work.

It may now happen that the man who is using the defective portable lamp is not aware that his lamp is at fault, and has caused the fuse to blow, and he only realises that his particular bank is out of order; therefore, he plugs his portable lamp connection into the next bank of sockets, with the result that that section is also put out of order. Frequently it happens that one defective connection is responsible for a number of dead banks of sockets, and thus it will be readily seen that an irresponsible person can put a large number of men temporarily out of action, causing a loss of time and money to both the employer and the employés; this also means that a staff of electricians has to devote much time to repairing blown fuses and repairing the flexible cables.

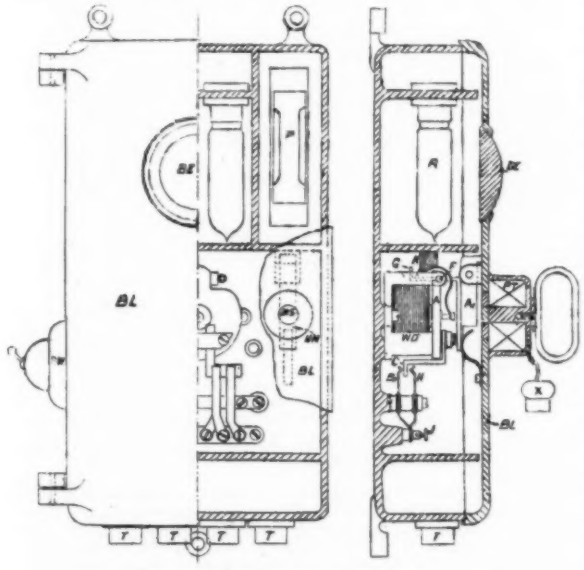


Fig. 1.—Hand Lamp Test Set.

In order to overcome this difficulty, the writer has devised an arrangement which clearly indicates to the man who is using a defective portable connection that his apparatus is out of order, and he immediately puts it on one side instead of causing the inconvenience above-mentioned.

Fig. 1 shows the suggested arrangement, which consists of a bank of connecting sockets T, indicator lamps R, R_1, contactor switch, main fuse P, and main switch S W.

Fig. 2 shows the method of operation. If the portable lamp plug is pushed into one of the sockets T, and the main switch S W is in the "on" position, the current will flow by way of the fuse P_1 through the portable lamp connection, and thence to the negative main, *via* the fuse P.

The portable lamp or lamps are now lighted up in a normal manner, but if for some reason or other the portable

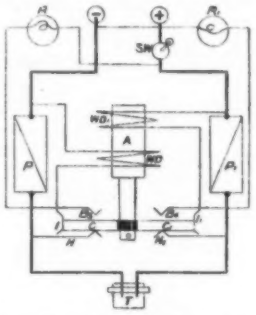


Fig. 2.—Diagram of Connections.

lamp or connection is short-circuited, a heavy rush of current passes through the circuit, and may blow one, or both, of the main fuses P, P_1.

It does not often occur that both fuses have exactly the same fusing current: we will assume that owing to a short circuit the fuse P_1 has been blown, thereby cutting off the current from the portable lamp. There is now an alternative path for the current to flow by way of the solenoid coil W D_1 to the brush I_1, movable contact C_1, brush H_1, and through the portable lamp connections in the socket T, and thence to the negative main by way of the fuse P.

The solenoid coil W D_1 now sucks up the plunger A, and the movable contact C and C_1, leaving behind the brush contact H_1, and connecting up to the brush contact B_1, thus disconnecting the defective apparatus, and at the same time lighting up the lamps R and R_1, thus indicating to the operator that there is something wrong with his portable fitting. The bull's eye B E (fig. 1) magnifies the power of the lamp R_1, and it can be readily seen by the electrician in charge of that particular department, who replaces the blown fuse immediately.

If for any reason it is found impossible to give the fuse-box attention, the lamps within the box can be switched off by opening the switch S W, but if an attempt is made to use the box by inserting a plug in the socket T, and switching on the main switch the indicator lamps immediately light up, thus informing the person using the lamp that that particular box requires attention.

If the fuses are easily accessible unauthorised persons are apt to replace them when blown, but as they do not realise the purpose of the fuses, they will put in any piece of wire they can lay their hands upon, and I have met with 5-ampere fuse bridges filled with wire of a fusing capacity of upwards of 30 amperes; of course, with such a fuse a short-circuit has disastrous results, sometimes seriously injuring the man using the portable apparatus. Ordinary locks and padlocks are of little or no use, as they are easily opened, and therefore a magnetic type of lock has been developed which cannot be got at from the outside of the fuse-box.

Attached to the box is a catch K, with which engages a locking catch G. On the inside of the box lid B L (fig. 1) a magnetic locking device is fixed, and the lid of the box B L (which is usually of cast-iron) has a hole drilled in it about 2 in. in diameter, in which a stud M S of magnetic material is surrounded by babbitt-metal N M, which is non-magnetic. The catch G is fixed to a movable armature A_1, which is pivoted at F, the catch G being held in engagement by a spring.

If the lid B L is closed, it is impossible to gain access to the fuses by ordinary means; but the electrician, who carries a small electromagnet P T, places the plug X in a convenient lampholder, after which the pole of the magnet is put on or near the stud M S. The armature A_1 is attracted to the stud M S, thus disengaging the catch G, and in attempting to draw away the magnet the door is opened, giving access to the fuses, which can be replaced, and on the door being pushed to it is automatically locked.

TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.

On Friday last, at Caxton Hall, Westminster, the Annual Congress of the Association was held; Mr. R. J. Howley presided, and papers were read by Mr. W. L. Madgen and Mr. H. England. In the evening there was an informal dinner. We give below abstracts of the papers and discussions.

Tramway Fares and Services.

By Wm. L. Madgen, M.I.E.E.

(Abstract.)

There are two criticisms which apply generally to tramways in the United Kingdom. The first of these is: That they fail to produce an adequate financial return to their proprietors; the second is: That in many respects they fail to give the community all the benefits of which they are capable. We have here a simple example of cause and effect—of what happens when a community is working a strangle-hold on an industry.

Both these criticisms apply in greater or lesser measure alike to the tramways owned by municipalities and to those owned by companies, and to a large extent these failures are the result of faulty legislation. This legislative handicap weighs with different force upon company and municipal tramways, but both are affected, and the remedies have not so far been within the power of any body but Parliament itself. The immediate object of this paper is to point out some ways in which it appears to the writer that the controlling bodies have a considerable responsibility for the failures mentioned, and have it within their power to bring about better results.

The first point is that tramways do not produce an adequate financial return to their owners. It is taken first for the reason that an insufficiently remunerated industry cannot provide the community with the full service of which it is capable under more encouraging conditions.

A prosperous industry can accumulate funds available for the improvement and extension of its activities or can attract the necessary capital for such purposes. A starved industry cannot do this. Municipal corporations can no doubt obtain loans upon favourable terms because they offer to investors the security of the rates, but they are naturally loath to increase municipal indebtedness for the extension of services which are not likely to be remunerative unless such services are obligatory. Tramway companies cannot obtain capital for extensions unless they can show that their existing enterprise is giving a reasonable return.

The effect of an industry being starved is felt in many other ways. The management and all in responsible positions are always conscious of a pinched feeling, deadening to enterprise and making them averse to trying changes which they know will have a temporarily adverse effect on the net receipts, although they believe that they would eventually give good results. This is particularly true of changes, the effect of which depends upon the education of the public, a process which inevitably takes time.

But it is not only the management and those in the more responsible positions who feel the pinch; it reacts on all employés. In the long run it is impossible for a harassed and despondent industry to make its conditions of service as attractive as those of a healthy and prosperous one.

Some of the directions in which tramways have failed to achieve their possibilities involve improvements which may take some years to become remunerative. It is not to be expected that a starved undertaking can venture on these.

Whilst a number of the municipal tramway systems show good financial returns they are none the less starved because the bulk of their net receipts are ruthlessly appropriated in aid of the rates, instead of being utilised in the improvement of the service. This point was well taken by Mr. McElroy in his report on the Manchester Tramways, wherein he showed that the whole of the extensive improvements recommended could be financed from the tramway net receipts if the City Council would refrain from appropriating £100,000 per annum for the benefit of the Borough Fund.

It is clear that for a service to be remunerative the sums charged for it must cover the whole of the costs, including capital charges, and provide a reasonable margin. It is also clear that the charges made for the service ought to be equitable; i.e., every passenger should pay his fair share of each of the items of cost involved in carrying him. In transport undertakings some of these items of the cost of service are proportional to the distance a passenger is carried. Some of them are more nearly represented by a fixed amount per passenger.

If, therefore, we can ascertain what these costs amount to *per passenger* in any given case, the result gives a sum which must be exceeded by the fares charged for the shortest journey. The fares for longer journeys should be increased over this minimum in proportion to the distances.

The results of such a scheme of fares, are—first, that every passenger pays his fair share; secondly, that the longer journeys are relatively cheaper than the shorter ones; and, thirdly, that the travelling expenses consequent upon living at a greater distance from the place of employment are less than proportional to the greater distance. The last-named effect would be of immense importance in making tramways of greater service to the community.

Taking "Standing Charges" to include all the costs of having the system equipped and ready to meet the traffic, and the "Running Costs" as those proportional to the passenger miles, we distinguish a figure for standing charges which can, with entire fairness, be spread equally over the whole number of passengers. The equity of this as regards passengers at the minimum fares is made more apparent by the fact that, taking all the tramway systems collectively, a far larger number of passengers are carried at minimum fares than at any others. This is true for at least the majority of individual systems. For the tramways of the whole kingdom the Board of Trade returns for the year 1913-14 show that the average receipts per passenger were 1.105d., proving that the number of passengers at one penny (the minimum fare on the majority of systems) is far in excess of those at higher fares. As an example of a particular system, Glasgow may be cited, where the minimum fare of one halfpenny was paid in the year 1918-19 by 63 per cent. of the total number of passengers.

The last published Board of Trade returns, viz., for the year 1913-14, represent pre-war costs, and require considerable modification to make them fit present conditions.

The gross profits amount to 7.03 per cent. of the capital expenditure. Allowing 4 per cent. for depreciation, the average net yield on the capital invested was only 3.03 per cent. This result proves that the tramway work in the United Kingdom is a starved industry, for a return of 3.03 per cent. is not sufficient to attract capital or to justify its expenditure, nor does it provide a margin for enterprise in improvements and extensions. The average receipts per passenger were 1.105d., of which standing charges absorbed 0.544d. and the running costs 0.561d. From this it follows that the basic or fixed charge per passenger to which running expenses proportional to the length of journey have to be added should exceed 0.544d. at pre-war rates, or, in other words, that in 1913-14 every passenger carried should have paid 0.544d. *plus* an amount varied according to the distance travelled. This fare would, however, have provided a yield of only 3.03 per cent. on the capital, which, of course, is quite insufficient.

A moderate yield is 6 per cent., amounting to 0.340d. per passenger. Taking the depreciation, &c., at 4 per cent., as before, gives 0.227d. per passenger; rent, rates, &c., as before, gives 0.090d. per passenger; and, taking 100 per cent. increase over pre-war prices for the items mainly made up of labour and material belonging to this side of the account, gives 0.120d. per passenger, making a total of 0.777d. as the basic figure for standing charges, to which must be added in each case an amount per mile travelled to cover running costs.

This basic figure of 0.777d. per passenger is rather on the low side, and leaves something to be made up by the passenger-mile charge for depreciation and return on capital, and meets the criticism that a portion of these charges is in fairness proportional to the use made of the system by each passenger.

A fair estimate of the average distance each passenger was carried in 1913-14 for the average fare of 1.105d. is two miles, or for running costs 0.281d. per passenger mile. At post-war prices of labour and material, this cost will be doubled, but let us take it on the low side at 0.55d. per mile.

On the bases set out a table of fares against distance would give the following figures:—

	Standard charges.	Running cost.	Total.	Rate per mile.
For 1 mile	7·77d.	5·5d.	1·32d.	1·32d.
„ 2 miles	7·77d.	1·10d.	1·87d.	9·35d.
„ 3 „	7·77d.	1·65d.	2·42d.	8·06d.
„ 4 „	7·77d.	2·20d.	2·97d.	7·42d.
„ 5 „	7·77d.	2·75d.	3·52d.	7·04d.

This table is an illustration of the plan on which an equitable fares table can be made up. It is believed to give fair average figures for United Kingdom tramways under post-war conditions.

It is submitted that this is a sound method of settling fares, and that it will tend to raise the tramway industry, legislation permitting, from the position of being starved to one in which it will be moderately prosperous, and therefore able to attract and to expend capital in improvements and extensions.

Of the failures to benefit the community as much as they should, by far the most important is that tramways have not brought about that spreading of the population of large and crowded industrial centres which they clearly can assist. It is admitted that they have done something in this way, but, on the other hand, it is believed that the practice of giving very low fares for short distances, which militates against reasonable financial returns, has another very serious effect, in that it encourages people to continue to live at distances from their work within the radius of the minimum fares. The table of fares given above shows that on a sound basis the fare per mile would be lower for long distances than for short ones. That is, a man living two miles from his work would not pay twice as much in tramway fares as one living a mile away.

Supposing that 500 journeys are made per annum, the expenditure on tramway fares for different distances will be as follows:—

	1 mile.	2 miles.	3 miles.	4 miles.	5 miles.
Annual cost ...	£2 15 0	£3 17 11	£5 0 10	£6 3 9	£7 6 8

Taking successive rings at distances of one mile, two miles, &c., from a given centre, that lying between 1 and 2 miles radial distance will have an area of nearly 9¼ square miles; that between 2 and 3 miles an area of 15¾ square miles; that between 3 and 4 miles an area of nearly 22 square miles; and that between 4 and 5 miles an area of 28¼ square miles. With these increases of living room it is at least probable that rents will decrease with increasing distance from the centre more rapidly than the annual expenditure on fare increases. There will be more room to live, more garden and park space, more sunlight and fresher air.

The importance of providing the poorer classes with these improvements in their living conditions is so well understood that it is unnecessary to dwell on it, but it has not been sufficiently recognised that a rapid and economical means of travelling over the greater distances between house and work is essential to the purpose, and that it is best afforded by tramways up to at least 6 or 7 miles from the industrial centres.

The most serious social fault of the systems of very low fares for short distances is that they discourage families from moving outwards.

It is at least partly due to this effect of low fares that the central districts of some of our large cities, such as Glasgow, have not been relieved of their overcrowded slums to anything like the extent which might have been expected from the operation of the very efficient tramways there. As above explained, this low-fare system charges the short-distance passenger less and the long-distance passenger more than his fair share of the standing charges, and is therefore a direct handicap upon the spreading of the overcrowded population. It is not because Glasgow has not made tramway extensions to long distances from the centre. It has done so in a few directions, but only seven of these spurs go beyond three miles from the central districts. Similar conditions as to fares and extensions prevail around other crowded centres, and the only reasons for mentioning Glasgow are that the Corporation has made a special feature of halfpenny fares, keeping them in operation throughout the war, and that 14 per cent. of the population are reputed to live in one-roomed "houses." If the Corporation had perceived the relation of tramway fares to overcrowding, there can be little doubt that it would have arranged them to encourage the spreading of the population rather than to discourage it. The crowding of cars by minimum-fare passengers has a tendency to drive away those wishing to travel longer distances and to encourage competitive services.

There are two obvious difficulties against setting up a rational fare system. The first is that tramway fares are generally limited to a maximum of one penny per mile, and any sound system—at present costs—must charge more than a penny for the first mile. Besides this general statutory obstacle, there are numerous provisions in special Acts and Orders, agreements between companies and local authorities, and the like, setting out scales of fares or maximum fares which cannot be reconciled with the principles laid down.

An entirely different set of circumstances has also had a serious influence upon the development of improved transport facilities by means of tramways and light railways. The rateable value of a town is in some degree a measure of the remuneration paid to some of its principal officials and of the personal prosperity of the trading classes, of which with a sprinkling of professional men the Council itself is largely composed. We must not regard these gentlemen as municipal Pharoahs who consciously and intentionally "will not let the people go," nor can we believe that they impose bad fare systems upon the tramways in order to keep the population within range for business purposes or to promote congestion; but we may urge that the community should be no longer subject to the "rateable-value" fetish which tends to provide particular attractions for the centres of population and an influence adverse to the provision of adequate housing arrangements in more healthy surroundings.

The working classes have been misled into the idea that the halfpenny tramway fare is an advantage to them, but as a cold and cruel fact the conditions which it helps to foster are the very worst in all respects for themselves and their children. There is very strong evidence that the contrast between the sheer discomfort of the crowded working-class quarters and the comfortable homes of those who are able to live in decency and comfort—though they may derive their incomes from the same industries as the workmen—is a chronic and growing cause of the unfortunate spirit which manifests itself in labour unrest. Of the many manifestations of this spirit during the war, it was noticeable that the worst and most persistent cases occurred precisely in those districts where overcrowding is most prevalent.

What labour needs above all things is to improve its living conditions, and one of the most effective means to that end is to spread the houses outside the industrial areas in bright and pleasant surrouundings, where the working man and his family can enjoy their allotments or other favoured occupations of their increased daylight hours and leisure time. To make this possible the lowest possible fares for the longer distances, and ample transport facilities for those districts, are essential. Both these conditions will be favoured by abolishing non-paying short-distance fares, graduating all fares in an equitable way, and making the tramways sufficiently remunerative to induce an enterprising spirit in the management.

Much could be done in many cases to improve the travelling facities by connecting up neighbouring tramways and instituting through running. There are many cases where the use of tramways has been greatly increased by such arrangements, clearly showing that adjacent but separate tramways do not serve the best interests of the public.

It is obvious, therefore, that a campaign of education and propaganda among the authorities concerned in favour of sound fare tables and a more tolerant spirit is urgently necessary, and the tramway interests should take up this work with energy.

There is another difficulty about the application of rational ideas to tables of fares, viz., the coinage. The table already set out gives the following figures for distances from one to five miles:—

Distance.	Fares.	Nearest coin value.
1 mile	1·32d.	1¼d.
2 miles	1·87d.	1¾d. or 2d.
3 ,, ...	2·42d.	2½d.
4 ,, ...	2·97d.	3d.
5 ,, ...	3·52d.	3½d.

For the first two miles the nearest coins include farthings, and, even so, the difference between the theoretical fare and the nearest coin is a somewhat large percentage of the total. Farthings are not popular. An attempt to rationalise tramway fares by the use of them was made some years ago on a number of systems, and after patient trial was withdrawn.

The penny has too small a value for the minimum fare, because the standing charges item alone is nearly 0.8d., and the length of ride which could be given for the 0.2d. balance is too small for a stage. Therefore the minimum fare must exceed one penny, and it should be a single coin. The writer strongly advocates the adoption of the decimal system of coinage approved by the Associated Chambers of Commerce, the Institute of Bankers, the Decimal Association and numerous other bodies. This system divides the £1 into 1,000 mils, and includes the provision of a 5-mil nickel coin of the value of ten to the shilling. This is equivalent to 1.2d., and would suit a rational system of fares very well. The value is a little lower for the mile distance as set out above, but that table is only an illustration based on collective figures. The actual length of the stages will in every case have to be adjusted to the circumstances and costs of the particular system. There is no more difficulty in fitting the stages to the coins of a decimal system than to the halfpennies and pennies now in use. Five mils is a better starting point than a penny or the nearly equivalent four mils, and there are very strong reasons in other directions for making the coin, which has probably the greatest use in retail transactions, of the slightly higher value.

The rational adjustment of fares which will put tramways on a sound financial basis, and enable them to play the part they should in improving social conditions will be, in the author's opinion, greatly facilitated by the introduction of a decimal system of coinage.

The author believes that the power of the tramway to give frequent service is not perhaps so generally recognised or utilised so fully as we may hope it will be under more encouraging conditions. Frequency of service has an extraordinary power of developing traffic. The aim of the tramway manager is to run every car mile on every route which will pick up anything in excess of its standing charges and bare cost of running. This object cannot be attained by calculating from the number of people served and the minimum service which can suffice them. To attain the object calls for a continuous study of the habits and tendencies of the population, their working hours, shopping hours and places and times of recreation, entertainment and any other factors tending to induce them to travel. This means adapting not merely the daily normal service, but adding more cars at suitable hours in accordance with the local circumstances. The formation of the travelling habit in the people living along any route, and the attraction to live on that route of people who have the travelling habit or travelling needs is fostered by the appeal of a good service more effectively than by any other means. It is clearly better to have a car making only a small net revenue per mile than standing idle in the shed.

An enterprising manager will keep his services rather a little better than apparent necessities than a little below them. Experience shows that this policy pays. In some instances a route which has not paid during the dull hours of the day with a poor service has responded so well to a more frequent service during those hours that it has paid continuously.

The author ventures to impress on members of the Association the opportunness of the present time for a vigorous propaganda in favour of the objects set out, and will conclude by summarising as follows: —

1. Tramways are not so successful financially as they should be, and for that reason not able to do all that they might for the communities they serve.

2. One reason for the lack of financial success is that fares are not graded so that every passenger pays his fair share of standing charges as well as the cost of carrying him; the fares chiefly in default are the short-distance fares.

3. Generally, the minimum fare should be rather over one penny, because the standing charges alone approach closely to that amount. Rational grading will cheapen long journeys and encourage that spreading of population and relief of congestion which is one of the principal social advances to which tramways can contribute, and at the same time give them the necessary financial strength to make the extensions and improvements needed.

4. The opposition to increase of the lowest fares is partly ascribable to shortsightedness on the part of the authorities concerned. It should be combatted by an educational propaganda wherever it exists.

5. Rational grading of fares will be greatly assisted by the adoption of decimal coinage with a 5-mil piece (1.2d.) as the practical unit for small transactions.

6. Frequent service is the best educating influence towards the formation of the riding habit among the public.

I desire to express my acknowledgment and thanks to Mr. A. W. A. Chivers and to Mr. H. M. Sayers for their collaboration in the preparation of the data submitted in this paper.

Discussion.

In opening the discussion, Mr. C. J. Spencer said he thought that the "standing charges" should be still larger than the author suggested; the fact that they amounted to ¾d. showed that the ½d. fare was uneconomical and unsound, and should not be used under present conditions. The minimum fare must be over 1d., and on his own system, under the powers available, a minimum of 1½d. had been adopted, which lifted the undertaking out of its difficulties. With a minimum fare of 1d., the short-distance passengers got off scot free, and the burden of increased fares fell entirely on the long-distance passengers, who in equity ought to pay less per mile. It was impossible to continue to operate the tramways under the existing conditions, in face of the rising expenditure and labour difficulties. Formerly 1d. per car mile was considered an ample provision for track renewals, but the funds accumulated on that basis were quite inadequate now, and should be at least doubled. They would have to organise their undertakings on more scientific lines. He agreed with the whole of the paper, and supported the proposal to start a public propaganda; it was contrary to the national interest that the tramway undertakings should be ill-served.

Mr. A. L. C. Fell referred to the hectoring attitude of the House of Commons Committee, which had treated tramway managers like criminals. He believed in fixing the fares as low as possible to encourage traffic and to induce long-distance passengers to use the tramways. The tramways, especially in London, had to bear extraordinary burdens; it was most unfair that they should have to pay for street improvements, while the omnibuses paid nothing, though they got the benefit of the improvements. They also had to pay rates on the permanent way, and to maintain the roadway which they did not wear out. At present in addition they endured extraordinary burdens in respect of labour; workmen should have a share of the profits, but they must first make sure that there were profits to share. Unless relief was obtained, many undertakings would go under or come upon the rates.

Mr. J. Dalrymple agreed with the author that passengers should be carried at the lowest possible fare after meeting all charges and making a reasonable profit. In Glasgow over 60 per cent. of the passengers paid ½d. fares, and the average revenue per passenger was only a little over ¾d. Many years ago he showed that it cost more than ½d. per passenger to place the cars on the streets, but the Glasgow Corporation extended the ½d. stage to more than a mile, and the result was remarkable; not only was the deficiency caused by the transfer from 1d. to ½d. made up, but so many more were carried at ½d. that they soon had a greater revenue than before. They had thought the cars overcrowded when they were carrying 11 or 12 passengers per car-mile; now they were carrying 20, and the revenue was higher than ever before. Hence it was very difficult to persuade the tramway public that there was any need to increase the fares, and if the conditions to-day had been the same as before the war it would not have been necessary to suggest an increase. Tramway undertakings could get their fares increased if they could show that their returns were less than in 1914; but very few could show that. He was not so anxious about the position to-day as that of two or three years hence, when there would be less money to spend on fares and the expenses would be much greater; then it would be a question whether with an increased fare they would get an increased revenue. In Glasgow every reduction in fares had resulted in increased gross revenue. The old fares had enabled Glasgow to carry on and wipe off all loans; but last year, in spite of their having no debt, they were only able to hand over £17,000 to the rates. He had suggested to the Corporation that the fares should now be increased—not to meet the existing conditions, but to have money in hand to help the undertaking in proper condition. An increased revenue was essential. In reply to a question whether the low fares had had any effect in preventing the population from spreading to the outskirts of the city, Mr. Dalrymple said he could not say that they had had much effect. Heads of families often had to travel considerable distances from the central area to their work, but the younger members were engaged in businesses in the centre and used the ½d. fares—and that might induce people to continue to live in the central area. There was no town in the Kingdom where so many people used the tramways; last year, with a population of about one million, they carried about 460 million passengers.

Mr. C. D. Stanley said that very low fares for short distances encouraged overcrowding of the cars for the first mile or so. The author would give the long-distance passenger more for his money, quite rightly; but how would he solve the problem above mentioned? The author had said very little about services, a very important question. At present they gave the long-distance passenger a low speed in the central areas, due to the traffic, and a low speed in the suburbs due to the frequent stops. The long-distance passenger wanted a car that made few stops and covered the distance in half the time; if the tramways could not meet his wants, the tramway system would not endure. The excessive number of stops should be reduced; stops might quite well be ¼ mile apart—people would walk more than 200 yards to a railway station. Acceleration of the service was most important. Non-stop trains on the underground railways had been a success, and the tramway problem was a similar one. Some of the cars should be run more or less exclusively for the long-distance passengers.

Mr. R. Hogge said the public did not need teaching; the tube fares had been raised 50 per cent., and the public had not resented the increase—what they grumbled at was the overcrowding. He had raised the tramway fares to 2d. without loss of traffic.

Mr. Soames did not agree that the public did not need education as to the true position of transport generally; the Committee that had considered London conditions was going to advise Parliament that the increase of fares was not justified, whereas an impartial view of the evidence must show that the increase was necessary. They should raise a fund of five or ten thousand pounds and carry out an efficient propaganda. His experience in both England and Wales showed that every increase of fares brought in increased revenue.

Mr. J. M. McElroy said that operating costs were up 100 per cent., and the passenger must pay. They must not draw wrong inferences by discriminating between standing charges and running costs; at Glasgow the standing charges divided by the number of passengers showed nearly ½d., implying that the ½d. fare was a loss, but the increased number of passengers upset that verdict. In Manchester they catered especially for the long-distance passenger, with the object of spreading the population, and statistics taken over 10 or 12 years showed that the spread was very remarkable. To meet the increased costs they had reduced the stages. In Manchester and other large towns they were meeting the expenses, but not in a beneficial way—they were overcrowding the cars. The great prosperity now apparent was not long-lived; the public would insist on better accommodation, and that meant higher fares.

The Chairman, Mr. Howley, said the discussion showed that the short-distance passenger was getting the benefit of the cheap fares; they must consider the question with the object of giving the long-distance passenger the best value and not giving the short-distance passenger too much; hence they must increase the short-distance fares. In many towns where omnibuses were worked under restrictions to prevent them from competing with the local tramways, he had found that the long-distance passengers were preferable. The passenger to-day was getting better value than before the war, in view of the depreciated value of money; there would be an outcry when the fares were raised, but the passenger would pay, and would in time realise that he was getting good value. But the accommodation must be improved. It was necessary to bring to the notice of the authorities and Members of Parliament the disadvantages of letting tramway undertakings get into a bad financial condition, like the railways. Much useful propaganda work could be carried on by individual and local effort; that was better than having a large central fund.

Replying, Mr. Madgen agreed that the question of services was very important, and that the burdens imposed on tramways were unjust. The propaganda should include the removal of those and other burdens. The Glasgow cars at ½d. fares were merely churning up the crowd in the centre of the city; Mr. McElroy had shown that his system had benefited the public by spreading the population. Propaganda did not need a large sum—personal effort would go a long way; but a moderate fund was wanted, and he suggested that it was a matter for the Council of the Association.

Electromobiles in Sweden.—It is announced from Stockholm that Mr. Lybeck, civil engineer, has paid a visit to the United States in order to make preparations in connection with the proposed introduction into Swedish towns of electromobiles and commercial vehicles from America. The firm which is to import the electromobiles bears the title of the Svenska Elektrobil A.B. and the first delivery is said to be already on the way, whilst further cars are expected to follow in the near future without interruption. Apart from passenger cars, Mr. Lybeck is stated to have purchased commercial electrical vehicles for the transport of loads of from 10 cwt. to 5 tons, and vehicles are also in course of construction in the States which are intended for omnibus traffic in the Drottninggatan, Stockholm, which the civil engineer in question hopes to bring into operation in the near future. In addition, it is hoped to be able to embark upon the manufacture of electric vehicles in Sweden.

THE BRITISH SCIENTIFIC PRODUCTS EXHIBITION.

(*Continued from page 128.*)

The Telephone & Microphone Co., Throwley Road, Sutton, Surrey, exhibits electrical aids for the deaf, comprising an instrument for testing the deaf to ascertain whether an electrical aid will be of use, and, if so, to discover the combinations of diaphragms, the volume of sound, and the form of sound wave most suitable in each individual case. It is on the principle of the test set used by ophthalmic surgeons. A series of electrical aids made up from prescriptions together with accessories used therewith are also shown. Although the testing instrument has been in use for about seven years, only three aural surgeons and two telephone engineers have used it; nevertheless, hundreds of instruments have been made up from the prescriptions written after using it. It is believed this is the only British firm making such aids. An electrical aid for the deaf is a special form of telephone, the instrument being made up of three parts: the receiver or ear piece; the transmitter or microphone; and a small dry battery. These three parts are connected together by means of insulated flexible conductors resembling a thin cord. The transmitter cannot be fixed incorrectly on the battery, nor can the cords be wrongly connected, as the terminals are so made that they will only fit the correct sockets. Fig. 5 shows the most

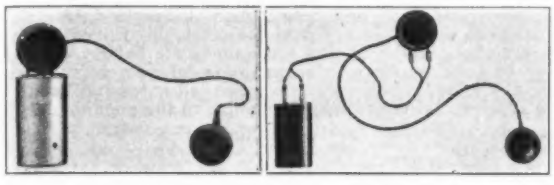


Fig. 5. Fig. 6.

Electrical Aids for the Deaf.

popular style of instrument, in which the transmitter is fixed to the battery and worn in a bag under the blouse or placed in the waistcoat pocket. Fig. 6 shows the old style of instrument employing a transmitter extension cord.

In fig. 7 is seen the test instrument, which will enable a combination of 90 different instruments to be prescribed. The case contains three standardised transmitters, three standardised receivers, a voltmeter for testing batteries, and two batteries giving 2.5 volts.

Figs 8 and 9 show two forms of the box instruments as distinct from the form worn pinned to the dress. The receiver

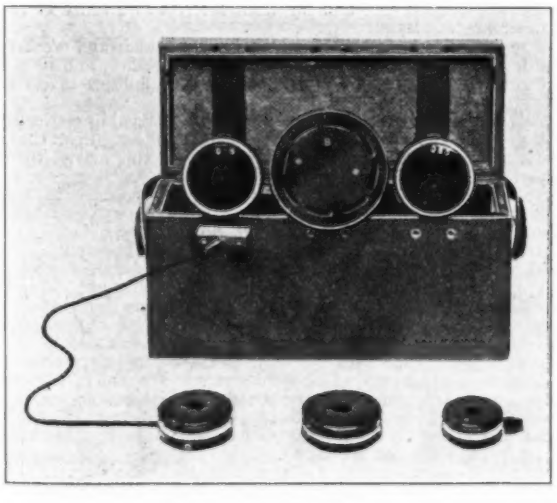
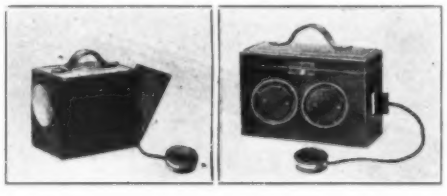


Fig. 7.—Testing Set.

varies in diameter, but is generally about the size of a watch, and is somewhat similar in construction to the small telephone watch receiver. The transmitter is approximately the same size as the receiver. The receiver, transmitter and battery can be built up into any form that the user desires. The receiver may be held to the ear by means of an inconspicuous head band made up of specially soft spring steel to enable the user to bend it to fit the head. The transmitter should be worn on the opposite side to that on which the receiver is being used; this minimises the buzzing in the receiver. Batteries last from one week to two months according to the type of instrument prescribed, the amount the instrument is used, the care taken in seeing that the battery is changed every day to allow it to recuperate, and in switching off the current when not listening to any sound. The transmitter and battery may be fitted into a box (figs. 8 and 9) or bag for placing on the table, or, if necessary, attached to any piece of office furniture to the user's taste. Proficiency in the use of the instrument is not immediate. It rests greatly with the user as to the eventual use which will be derived from it.

It is found that the various cases require different transmitters according to whether they are suffering from middle-ear or nerve deafness. If an individual hears better in a noise, then a transmitter which in itself makes a noise will be used; other cases require different receivers to suite the loss in high or low tones; for instance, in cases of nerve deafness, to compensate for the loss of high tones, and in cases of middle-ear deafness to compensate for the loss of low tones. This is compensated for by altering the diameter of the receiver diaphragms, and it may be mentioned here that in some cases the marked difference in hearing and in not hearing at all that is made by a very small alteration in the diameter is astounding. When the correct transmitter and receiver have been fitted, the next step is to obtain the right strength of instrument, and this is done by moving the receiver diaphragm nearer to or farther from the pole pieces of the electro-magnet of the receiver.

In order to facilitate the testing of patients, a test set has been devised (fig. 7) which is fitted with a number of different standardised microphones, or transmitters, varying in construction, and a number of different standardised receivers varying in diameter and thickness of diaphragm. These receivers have a very accurate measuring arrangement, so that, after having adjusted the distance of the diaphragm from the electro-magnet pole pieces, that distance may be read to one-thousandth of an inch. A standard battery is used on the test instrument. It is so arranged that any receiver can be plugged into circuit with any transmitter, and for testing this is done until the particular combination of receiver and trans-



Figs. 8 and 9.—Box Types of Instrument.

mitter is found with which the voice is most articulate. With practice one is able to eliminate a number of instruments, judging from the previous diagnosis. Then the most suitable transmitter is found, and finally the power of the instrument is decided by carefully regulating the distance between the poles of the electro-magnet and the diaphragm of the receiver.

In a great many cases one ear is worse than the other, and in most cases it is advisable to fit the electrical aid to the worse ear; this allows free use of the better ear and takes the strain off it. Generally speaking, the very deaf can be fitted better than the slightly deaf; hence the best result is often obtained by using the aid for the worse ear. An aural surgeon sometimes has one ear of a patient fitted with an instrument while he is treating the other ear, so that the ear under treatment is not used as much as it otherwise would be.

The different wave forms given by these instruments are very noticeable. The oscillograph shows that the instruments mostly used for the very deaf are those which give a wave form most *unlike* the telephone of commerce or human speech.

British Electric Vehicles, Ltd., Churchtown Works, Southport. In many modern factories, works and warehouses the electric industrial truck has come to be regarded as a most essential, indeed indispensable, adjunct to the equipment. B.E.V. electric industrial trucks are most economical in upkeep, ¼d. per hour is approximately their running cost, and they are practically "fool-proof," so that those totally unacquainted with machinery can with safety be entrusted to operate them. They are manufactured in five different standard patterns and capacities, in addition to being built to meet special requirements when so desired. We illustrate three different types below. Fig. 10 shows the "Whippet" 3-wheel 4-wheel pattern to carry 15 cwt., and fig. 11 shows the "Loco" type capable of hauling 10 tons. The "Little Giant" (fig. 12) standard half-ton truck is the one exhibited; it has a loading space 3 ft. wide by 6 ft. long, the battery comprises 14 cells of the Chloride "Ironclad" pattern with a 129 ampere-hours capacity at 25 volts, and is guaranteed for two years. The charging rate is 20 amperes at 25 to 40 volts and boosting charges up to 50 amperes can be given when necessary. The motor is fitted with ball bearings, and will stand an overload

of 300 per cent. Three speeds in either direction are given by the controller, which is fitted with renewable fingers and contacts. A bell push is fitted to the controller handle. The frame is 0.3 in. × 1.5 in. mild steel channel with 3 in. × 3 in. angles for carrying the motor, all securely bolted and rivetted together.

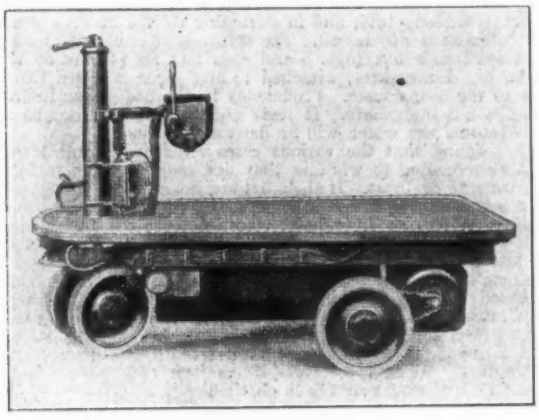


Fig. 10.—"Whippet" B.E.V. Electric Truck.

The 12-in. malleable-iron wheels are of the solid web pattern, and each is fitted with two large ball bearings; 1.3 in. × 1½ in. solid rubber tyres, mounted on a steel band, are pressed on to the wheel and are easily renewable. Transmission is by chain from the motor to one rear wheel, while the brake,

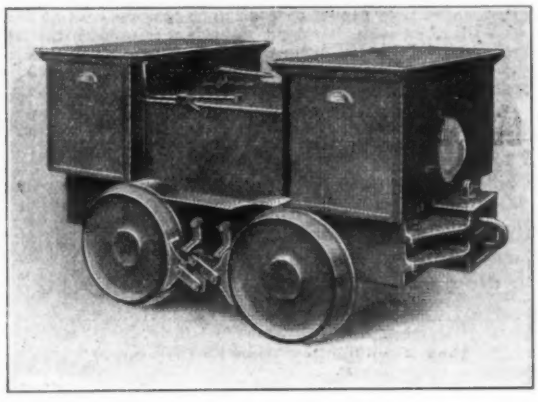


Fig. 11.—V.E.V. 10-ton "Loco."

which is normally "on," is of the external expanding pattern, operated by a foot pedal and lined with "Ferodo" brake lining. A switch is interlocked with the brake, cutting off the current when the brake is on, and *vice versa*. The springs, of the spiral pattern, are fitted to the rear wheels only, and

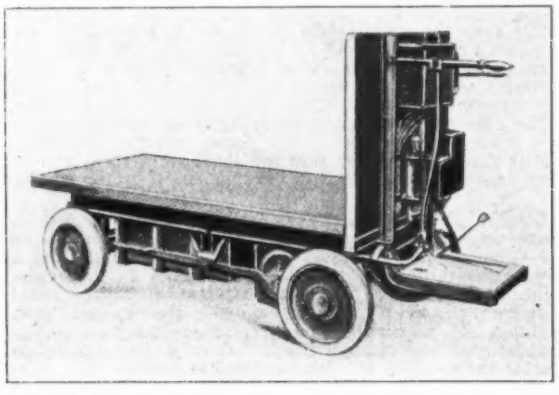


Fig. 12.—"Little Giant" B.E.V. Electric Truck.

the axles, of 3 per cent. nickel steel, are 1.5 in. diameter. The rated speed of this vehicle on the level is 20 to 25 miles per hour, and the mileage, also on the level, 20 to 25 miles per battery charge. The height of the platform is 1 ft. 10 in., and the clearance under truck 3 in. when loaded.

Major A. C. Fuller, Signals Experimental Station, Woolwich Common, S.E.18, exhibits "Fullerphones." Major Fuller's paper descriptive of his system and instruments, which was read before the Institution of Electrical Engineers last session, will not have been forgotten.* This system of telegraphy possesses unique properties; the method was employed by Great Britain and the Allies during the war, as it could be used in the forward area without the messages sent being overheard by the enemy. The Germans admitted this fact; they copied the instrument and commenced to use it themselves towards the end. Many thousand sets of these instruments were manufactured in England during the war, and samples were also provided to guide manufacture in France and America. The chief characteristics of the method are secrecy, portability and the capability of working over very long and bad lines with a very minute battery. Telegraphy and telephony can be carried out with the same instrument.

Messrs. Arthur Lyon & Wrench, Ltd., Victoria Road, Willesden Junction, N.W.10, are exhibiting the "Lyon Brotherhood" domestic electric lighting plant designed to provide light and power where public mains are not available. We described some of this firm's products in our issue of March 21st, 1919. Referring to the plant exhibited, the engine and dynamo are built together into one unit; the crank-shaft and spindle is in one piece with the armature shaft and the crank case is spigotted and bolted direct to the dynamo frame. Consequently good alignment is obtained automatically. The armature is built on a sleeve which can be withdrawn from the shaft, and all parts of the plant are easily accessible. The sets are made in standard sizes with outputs of from 0.5 to 1 kw. "Polar" type, and 2 to 4 kw. "Major-Domo" type, and are supplied complete with batteries, switchgear, &c. All parts are standard and interchangeable, replacements and repairs can therefore be effected without highly skilled labour. In operation, simplicity has been aimed at; battery starting may be arranged for with automatic features to prevent accidental discharge; but, apart from this, all automatic features are avoided, and the switchgear reduced to the minimum.

(To be continued.)

CORRESPONDENCE.

Letters received by us after 5 p.m. on Tuesday *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Government Service.

The leading article in your issue of the 18th inst., regarding employment in Government offices, impels me to protest against some of the statements made by the writer.

After nearly four years in the service of the Ministry of Munitions, preceded by some 14 years on the commercial staff of a large electrical manufacturing company, my experience is that, at any rate during the war, more work was done, longer hours were worked and for lower pay than would be the case in similar commercial positions. Moreover, I have been struck by the zeal and energy with which much of this work was carried out, and the keen interest and sense of responsibility displayed.

I myself and very many others have worked, and worked hard, for 10 to 12 hours a day for months together, and by no means entirely on routine work, the responsibilities involved being often very considerable.

As to salary, up till a few months ago I was paid practically my pre-war salary, which was then increased by 10 per cent. only, and many others were less fortunate in this matter than myself.

Taking into account that many people, especially in the higher positions, offered their services without pay, that very many others who were unable to do this accepted, from patriotic motives, the lowest salaries on which they could live, and that others again were glad to escape military service by taking any position in Government service (this last class, I think, not very numerous), on the whole I consider that the salaries paid have been distinctly low.

I for one have no intention of going back to commercial life at the salary I have been receiving in Government service.

I have no experience of Government employment in normal times, and the remarks in your article may be to some extent true (though I should hesitate to believe them true of many keen and energetic civil servants whom I have happened to meet in the course of my work).

But I am quite sure that anyone who had been through the mill as I have during the last few years would entirely disagree as to a spirit of slackness prevailing during the war.

There are, of course, and have been, slackers, some of them highly paid. No doubt also mistakes have been made, both in policy and in matters of detail, but in what organisation do these things not occur?

M.O.M.

London, S.W., *July 29th*, 1919.

[We are only too glad to receive this statement showing that there is, as usual, another aspect to the question; unfortunately the accounts which have reached us hitherto have been almost uniformly in accordance with our leader, which was based upon personal experience of work in a Government department in war-time.—Eds., Elec. Rev.]

* Elec. Rev., May 2nd, 1919, p. 515.

Overhead versus Underground Transmission.

Mr. Pearce's paper emphasises rather prominently the troubles of voltage drop in overhead lines, and dwells complacently on the great virtues of the capacity current in cables; but it quite overlooks the fact that the latter may be a slightly unwelcome asset, because it is a *distributed* capacity and therefore has the effect of over-nullifying the self-induction at the near end of the line, and leaving the distant end still in trouble. The real remedy for every trouble is increase in the voltage. If he had taken 90,000 volts instead of 30,000 the showing would have been altogether different. The copper resistance drop is the governing factor in the situation rather than the reactance drop.

In his 10-mile 30,000-volt scheme the copper resistance drop is roughly 2.5 per cent., the main-line current per circuit is 200 amp., the reactive drop 2,070 volts, the equivalent lagging current due to this drop is roughly 13.7 amps. per circuit, and the condenser leading current roughly 0.9 ampere.

By raising the voltage to 90,000 the copper resistance drop (with one-third the copper section) becomes 0.83 per cent., the main-line current per circuit is 66 amperes, the reactive drop is 690 volts (0.76 per cent.), the equivalent lagging current due to this drop is roughly only 1.53 amperes, but the condenser leading current rises to 2.7 amperes per circuit.

Therefore, although a "distributed" capacity and therefore not fully effective, the condenser current practically wipes out the self-induction, on a line having no tappings.

The voltage variation being now reduced to 0.83 per cent. we can extend the radius of transmission to 30 miles and, if we dare venture a 5 per cent. rise, to 60 miles. The 0.76 per cent. reactance drop is, of course, in quadrature with the current and on unity P.F. would be quite negligible.

With cables, on the other hand, the dielectric losses would run up enormously, and be a very serious item; even were the cables forthcoming, which they are not. Then, again, the difficulty of the heating of cables in clusters, when underground, disappears when put overhead; and to those who have studied the dielectric loss question and know how supremely important it is that the temperature should be kept low, if cables are not to break down, the importance of this point will appeal strongly.

It would be interesting to know whether the replacing of the individual overhead conductors by squirrel-cage "shell" conductors, on the lines of wireless *aerials*, has ever been tried. I should expect from theory that the reactance drop could be halved and the condenser current doubled—a 6-fold improvement.

It will be realised that, if the purely copper losses can be brought down, in the manner indicated, by raising the pressure, the whole economical aspect requires reconsideration.

A. M. Taylor.

P.S.—It is perhaps worth pointing out that the lagging component of the main-line current, due to the reactance of the line, diminishes in proportion to the *square* of the increase of voltage; and that the proportion which the leading component of the current bears to the main-line current (for a given KW. transmitted) increases also as the square of the increase of voltage.

DRY CELLS.

Information regarding the construction, testing, and characteristics of the dry cell is difficult to obtain, and therefore our readers will probably welcome the publication of Circular No. 79 of the U.S. Bureau of Standards on "Electrical Characteristics and Testing of Dry Cells," which was recently issued. The importance of the industry in the United States may be gauged by the statement that the output in 1904 was under 5 millions; in 1909 it was nearly 34 millions, and in 1914 no fewer than 71 million cells were made. Probably the present output is well above 100 millions. The rapid development of the industry is due partly to the improvements in construction, but very largely to the introduction of the economical tungsten-filament lamp. In the dry cell the zinc usually serves as the container; the electrolyte consists of a water solution of ammonium chloride, zinc chloride, and other compounds, held in absorbent material lining the container, and in a mixture of ground carbon and manganese dioxide which occupies most of the interior of the cell; sometimes the electrolyte is made into a jelly with gum tragacanth, agar-agar, gelatin, flour, or starch. In American practice the top of the cell is usually completely sealed. A partition is provided between the zinc and the depolarising mixture. When the cell is new, the surface of the composite carbon-manganese dioxide electrode may be considered to be the outside surface of this mixture, but as the cell is discharged the MnO_2 is reduced and the effective surface of the electrode travels towards the carbon rod in the centre, which only serves to conduct the current out of the mixture to the terminal.

The zinc used for large cells is from 0.014 to 0.020 in. thick, depending on the nature of the service; for long life the thicker gauge is used, but cells for heavy duty are often made with thinner zinc. For flashlamp cells the zinc is usually 0.10 or 0.13 in. thick. The metal must be of a high degree of purity and have a high tensile strength of elongation. Very pure zinc is often soft and liable to split. Some failures are due to local corrosion of the metal, sometimes at the lap in the paper lining. Local corrosion is due to unequal distribution of the electrolyte or uneven fitting of the paper lining; impurities in the metal or inequalities of structure also cause local action. Small amounts of copper in the electrolyte are fatal to the cell. Amalgamation is liable to weaken the zinc. Variations in the resistance of the mix may cause unequal distribution of current and consequent local perforation of the zinc.

The carbon rod must be of low resistivity; fluted rods are less liable to become loose than cylindrical rods. The resistivity of the manganese dioxide is so high that it may be considered a non-conductor. Granulated carbon is added to improve the conductance of the mixture, and should have a low resistivity, so that the proportion of MnO_2 may be kept as large as possible. Much depends upon the size of the carbon granules. Graphite has a lower resistivity than carbon, and is sometimes added. The bulk of the MnO_2 comes from Brazil, the Russian supply having been cut off. India contributes a small amount. The material should contain 85 per cent. MnO_2 and less than 1 per cent. of iron, but in the absence of the Russian supply inferior qualities have had to be used. For small cells artificial MnO_2 of a high degree of purity is largely used. The qualities of fineness and porosity are of great importance.

Zinc chloride is added to the solution of ammonium chloride to reduce the corrosion of the zinc by the latter salt when the cell is idle. The salts should be free from other metals and from negative radicals such as sulphates, which form compounds less soluble than the chlorides.

The sealing compound is usually a rosin sealing wax or a bituminous pitch. A filler of secret composition is generally added. The compound must make good contact with the

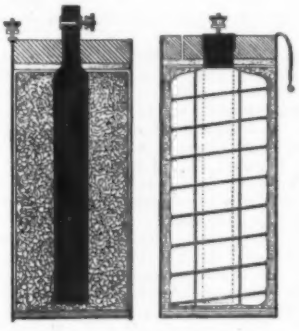


Fig. 1. Fig. 2.

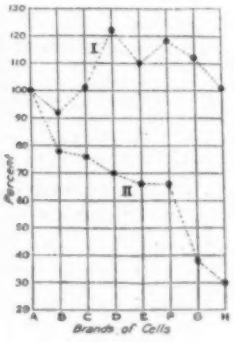


Fig. 3.

Fig. 1.—Section of Paper-lined Cell.

Fig. 2.—Section of Sack-type Cell.

Fig. 3.—Relative short-circuit Current and Service Capacity of 8 Brands of Cell. Curve I., Initial Short-circuit Currents; Curve II., Service Capacity, both referred to Brand A.

zinc and the carbon rod, but the cell should not be hermetically sealed, as gases must escape during the operation of the cell. The compound should not be brittle when cold or liable to flow in hot weather. A cardboard tube surrounds the zinc container, but a carton of waterproof material, an integral part of the cell, enables the latter to be used after the zinc is eaten through.

Before the cell is filled with the depolarising mixture a lining of pulpboard consisting of sulphite fibre and ground wood is placed in the cell as an absorbent and separator. The same material is placed in the bottom of the cell, and the lining is folded down on the top of the MnO_2 mixture (fig. 1). This is American practice, and is cheap, but is not as good as European practice in which the MnO_2 mixture is contained in a "sack"; the carbon rod with its surrounding mixture is wrapped in muslin and tied with string, forming a unit which can be placed in the zinc can, leaving space for the electrolyte in the form of a paste. The electrolyte is thickened with flour or other material, often containing secret ingredients. The latter construction (fig. 2) is almost universally used for small flash-lamp bateries, having good lasting qualities; it is preferred for all sizes in Europe partly because of cheap labour, and partly because the European purchaser does not judge a cell by its short-circuit current, a common practice in the United States. Some European cells are made with plaster of Paris mixed with the electrolyte to form a paste, which surrounds the MnO_2 mixture. Others ("desiccated") both paper-lined and of the sack type are made quite dry, and require the addition of water before use.

Particulars are given of the sizes of dry cells made in the United States, and it is pointed out that the cylindrical form is the easiest to manufacture and the most efficient for the type with an absorbent paper lining; square cells should be of the sack type. Cells are made specially for ignition and heavy service, general purposes, and telephone or light service, and comparative tests made by the Bureau show that the distinction is justified, ignition cells giving over 20 per

cent. more service than telephone cells when used for ignition, while telephone cells give nearly 20 per cent. more service than ignition cells on telephone work. The ignition cells give 1.5 volts on open circuit, and about 30 amperes on short circuit when new. Intermediate cells give about 25 amperes on short circuit and telephone cells 20 amperes. Flash-light and miniature cells are made in some 15 sizes, of which the following are regarded as standard:—

Diameter. Inches.	Height. Inches.	Weight. Oz.
⅝	1¾	¾
¾	2¼	1¼
15/16	1 13/16	1½
1	2¼	—
1¼	2¼	3
1¼	2⅝	3½

A type of cell which is known as "semi-dry" is entirely different from the ordinary dry cell; it stands 10 in. high × 5 in. in diameter and weighs 10 lb. A steel electrode replaces the zinc electrode; the open-circuit voltage is 0.9 volt, and the short-circuit current is 4 to 6 amperes. This type is intended for closed-circuit work in telephony and telegraphy.

Small cells having zinc and silver as the electrodes, with silver chloride depolariser, are frequently used in medical apparatus and some wireless apparatus.

Dealing with the electrical characteristics of dry cells, the report states that cells giving the largest short-circuit currents often, but not necessarily, deteriorate the most rapidly, and are therefore of service only for heavy duty which will exhaust them before their usefulness is impaired by deterioration while standing on open circuit. In the United States the tendency towards cells of very large "flash" currents has been partly due to a mistaken idea that the more current that can be drawn from a cell, the more service it will render. European cells generally have a higher internal resistance than American cells.

Temperatures above 77 degrees F. are generally detrimental to dry cells. Heat tends to produce leakage, and increases the rate of the chemical reactions taking place within the cell. Whilst in storage or transit cells should be kept as cool as possible. Cells kept for ten weeks at 41 deg. F. showed a decrease in short-circuit current of only 4.4 per cent.; at 77 deg. F., 10 per cent.; at 113 deg. F., 25 per cent.; and at 167 deg. F., 98 per cent. On the other hand, for heavy service a moderately high temperature gives the highest output; for light service a low temperature is best.

The output of dry cells depends upon the class of service, and is therefore difficult to test. As the load is increased, the hours of service rendered are more than proportionately decreased. No method of making accelerated tests has yet been found which takes account of all the factors affecting the performance of the cell. For open-circuit tests the voltmeter should have at least 100 ohms resistance per volt. The initial voltage is usually from 1.50 to 1.65 volts; higher voltages do not indicate superiority. Lower voltages than 1.45 may indicate deterioration. The open-circuit voltage test alone is of little value, giving no indication of service capacity. For short-circuit tests a dead-beat ammeter is required, and the resistance of the leads and ammeter shunt should be from 0.01 to 0.002 ohm. The leads should be tipped with lead to make good contact with the brass terminals of the cell. Tests should be made at about 70 deg. F. The test gives no indication of the service capacity of different brands of cell, as is shown by fig. 3, but is useful as indicating the condition of the cell compared with other cells of the same brand.

The decrease in service capacity does not necessarily correspond with the decrease in the short-circuit current due to age.

The open-circuit and short-circuit tests are the only ones at present in use that can be easily and quickly made without destroying the cells.

Intermittent tests have been made to imitate the use of cells under average conditions. The "ignition test" is made by connecting six cells in series to a circuit of 16 ohms for two periods of one hour each per diem, the periods being 11 hours apart; the test is considered complete when the impulse current through 0.5 ohm at the end of a period of discharge falls below 4 amperes. The result is expressed in terms of hours of actual discharge. The "telephone test" is made by discharging 3 cells in series through 20 ohms for ten 4-minute periods in 10 consecutive hours of 6 days per week; on the seventh day every other period is omitted. The test is finished when the closed-circuit voltage of the battery at the end of a period of contact falls to 2.8 volts. The result is expressed as the number of days the test lasted. The "flash-light test" is made by discharging the battery for a five-minute period once a day through a resistance of 4 ohms per cell in series, until the working voltage falls to 0.5 volt per cell. The result is expressed in minutes of actual discharge. It is necessary to use fixed resistances instead of lamps for this test.

Continuous tests are simpler to make, but afford less information about the value of the cells in actual service. Large cells may be discharged through a resistance of 10 ohms each until the voltage has fallen to, say, 0.75 volt per cell. Discharging flash-light cells through a resistance of 2.75 ohms per cell in series gives the best approximation to the actual life of the cell discharging at 0.35 ampere through a lamp, but the continuous test gives no clue to open-circuit deterioration. An important test is storage of cells on open circuit at room temperature, and periodically making open-circuit voltage and short-circuit current readings.

The report concludes with detailed specifications for dry cells, standard dimensions, &c. The following are the results expected of satisfactory cells:—

Diameter. Inches.	Height. Inches.	Test.	Service required.
2½	6	Ignition	34 hrs. discharge
3½	8	"	105 hrs. "
1½	4	Telephone	30 days
2½	6	"	140 "
3½	8	"	280 "
1½	4	10 ohms cont.	180 hrs. discharge
2½	6	"	
3½	8	"	
⅝	1¾	Flash light	50 mins.
¾	2¼	"	150 "
15/16	1 13/16	"	——
1	2¼	"	——
1¼	2¼	"	600 mins.
1¼	2⅝	"	——
⅝	1¾	2·75 ohms cont.	45 mins.
¾	2¼	"	140 "
15/16	1 13/16	"	85 "
1	2¼	"	260 "
1¼	2¼	"	425 "
1¼	2⅝	"	600 "

STEAM RAILROAD ELECTRIFICATION.

By CALVERT TOWNLEY.

(*Paper read before the* American Institute of Electrical Engineers, *March 14th*, 1919.)

Electricity now performs every railroad service previously rendered exclusively by steam locomotives and in every case does it better than it was done before. But in order to use electricity a large investment in equipment and installation must be made, and electrification has proceeded slowly because railroad executives were not convinced that the advantages to be gained were always worth the cost.

The progress of electrification has also been impeded, first, before the war by the difficulty in financing, due to conditions other than the merits of electrification, and second, since the war began, because every one has been too busy to consider any work that could be deferred and because the Government's taking over the railroads has created an unsettled situation not conducive to the investment of new capital for future returns. Now, however, there seems to be ground for hoping that these bars to progress will be removed in the not distant future, so that electrification can be again studied on its merits, therefore our consideration of the subject is timely.

In reviewing the past twenty years' history of this question, I cannot escape the conclusion that we electrical men, and not our steam road colleagues, are responsible for the slow progress made. We have not known enough about either the science or the art of railroading. Our belief in, and our zeal for our own profession has led us, albeit with entire honesty of purpose, to make more or less extravagant claims as to what we could do and to underestimate the cost of doing it. The inevitable reaction of mind which followed an accurate determination of facts of course disturbed confidence in our judgment. But if at times we have injured the cause of electrification by claiming too much, strange as it may sound, we have injured it a great deal more by not claiming enough. Electrical engineers not having always been railroad men, have been unable to study railroad problems as they should have been studied, that is to say with only real and not with any arbitrary limitations before them. It has been natural for the electrical man to ask the railroad man for a statement of the conditions he was expected to meet. It was equally natural for the railroad man to prescribe the conditions upon which his steam service was predicated. Under these circumstances the problem became largely one of replacing one sort of locomotive with another, and of balancing hoped-for economies in operation and maintenance on the one hand, against fixed charges for the additional investment required on the other. Right there comes the mistake. A perfectly natural but yet a fundamental mistake, for which no individual or class should be censured but for which the unusual development of the art is responsible. We cannot blame railroad men for not being electrical engineers nor electrical engineers because they are not railroad men, but the progress of electrification has had to lag until both should be able to see, each with the eyes of both. It is only by combining the railroad man's knowledge of the fundamental requirements of his service with the electrical man's skill in applying electricity to perform that service that all the possibilities of any specific problem may be developed.

The electrification of a railroad is not simply the substitution of one kind of locomotive for another. It is far more than that. It is the adoption of a fundamentally different method of train propulsion. It is conservative to say that, within the bounds of ordinary practice, electricity can furnish every train with all the pulling power that can be used. The limitations of the steam locomotive in this respect disappear and ruling grades rule no longer. A strictly limited motive power is replaced by one that is practically unlimited.

There are a number of so-called "systems" of electric

traction, and heavy emphasis has been laid by the advocates of each upon its points of difference from every other. So much has been said about these differences and so little about the points of similarity as to create an entirely misleading impression. It is a fact that there are more kinds and types of steam locomotives in use many times over than there are electric systems. It is a fact that except for the storage-battery locomotive, which has but a limited field of application, all electric systems have many more common features than differences. It is a fact that they agree on fundamentals and differ in detail only. Their costs may not be the same, their efficiencies may vary, but they all do their work and do it successfully and well. The possibility of unlimited electric power is a characteristic not of any one system but of all. It is due to basic differences between steam and electric equipment. A steam locomotive is a complete independent unit which not only generates but also utilises its power. The electric locomotive generates no power at all. It is only a translating device receiving energy from an outside and a remote source. The electric power house always having much greater capacity than any one locomotive, can supply ample power for the heaviest train on the steepest grade. The steam locomotive which carries its own power house with it is limited to the capacity of its one boiler. By the multiple-unit principle, as many electric locomotives as may be needed can be coupled together and operated in synchronism by one crew from any cab. Any required tractive effort can thus be exerted without slipping the wheels, without imposing undue strains on the rails or bridges, and without increasing the number of engine crews.

The business of a railroad is to transport freight and passengers. I put freight first because on the average it produces 73 per cent. of the revenue. Unlimited motive power permits longer trains and higher schedule speeds. On the Elkhorn grade of the Norfolk and Western the schedule speed was doubled. It cuts the operating cost by hauling more cars with the same or a smaller crew. The Norfolk and Western uses two electrics to do the work of three Mallets. These new opportunities at one fell swoop banish many of the railroad's time-honoured traditions. The traffic possibilities must be studied from a new angle and advantage taken of every facility. It is a new thought to realise that train length is limited not by motive power but by the yard tracks and length of sidings, or that all the trailing tonnage that the draw bars will stand can be hauled. Nor are these new limits fundamental. Sidings can be extended, draw bars can be made stronger, if it pays to do it. In a word, electrification opens up tremendous possibilities of increasing the freight capacity of a road, and without its being necessary to build additional tracks.

While not as important as freight, passenger traffic likewise comes in for its share in the widened horizon and the vanishing tradition. Unlimited power of course is available, but the absence of combustion is another basic advantage. Smoke and cinders disappear. Tunnel operation loses its terrors. Unobscured signals permit normal speeds with undiminished safety. Projects like the Pennsylvania terminal in New York depending entirely on submarine tunnel operation, and previously impracticable, become immediately possible. Railroads owning valuable realty in cities can erect buildings thereon, where before smoky locomotives made any structure above the ground level impracticable. The aerial rights are now valuable. Multiple-unit operation has in fact made suburban traffic. The rapid acceleration made possible by electric traction has directed attention to the equal value of rapid retardation and has quickened the study of braking accordingly; also of modified coach design to bring about the more efficient loading and discharge of passengers. These combined possibilities secure increased schedule speeds and attract patronage. The people not only get over the line in a shorter time, but as a corollary more people get over it in the same time. Again it is seen therefore that in passenger as in freight traffic, the ability to do something that could not be done before, rather than to do the same thing at a lower cost, is the most valuable attribute of electrification, and again we find a greatly augmented capacity without the need of additional tracks.

It is not my purpose to make an exhaustive comparison of the relative advantages of steam and electric operation. That has been done often and well by others. What I have said about the expanding opportunities for electrified service is by way of illustration to emphasise my plea that the question should always be viewed in its broader aspect, and not hampered and restricted within any narrower limitations than properly belong to it.

I am going to assume, then, the broadest possible treatment and to suppose that every electrification project is to have its pros and cons most fully examined. The real and vital question then is: "How far will this lead us?" To what extent may we expect complete electrification of all our roads?" Parts of a number of them have already been equipped. Many of these are numbered among our prominent roads, successful corporations which have had the advice of the most highly skilled executives and engineers, and which are progressive. The service performed on the electrified sections comprises practically every kind of railroad transportation. The Bluefield division of the Norfolk & Western R. R. in West Virginia is an example of an important coal road operating through the mountains. The Chicago, Milwaukee, and St. Paul 440-mile main line, through Idaho and Montana, demonstrates what can be done by a transcontinental carrier on a large scale with through traffic, both freight and passenger. The New York, New Haven, and Hartford R. R. 73-mile stretch between New York and New Haven shows how through freight and a heavy passenger traffic can be taken care of on the most congested four-track section of an important eastern carrier, and what is possible for complicated freight yard operation, while the New York Central and the Pennsylvania out of New York City are splendid examples of our greatest modern passenger terminal electrifications. There are, of course, many other electrifications, but even if there were not, those named are of a character to command the respect and attention of the railroad world. Now, every one of these projects has been successful. Every one has justified itself. Nearly every one in its present scope represents an extension of the zone initially electrified, the most convincing evidence possible as to what views the operating companies hold regarding these several projects. Railroad officials are generally glad to give others the benefit of their experience, so it is reasonably safe to say that operating statistics are available covering long enough periods, so that the results to be expected from any proposed undertakings may be predicated on established facts and not upon theories. In the light of present-day knowledge, therefore, what answer can we make to the question: "Should all railroads be electrified?"

Taken together in 1910 there were in the United States 240,000 miles of railroad main line, regardless of the number of tracks. Of this mileage approximately 1,250, or one-half of 1 per cent. has been electrified or is to-day in process. The remaining 99½ per cent. comprises, of course, roads performing every variety of service. They range from the back-country branch line built by some over-enthusiastic promoter and now, perhaps, operated as part of a large system, only because operation cannot be avoided, and regularly contributing its annual deficit, up to the most important through arteries of travel upon which the commerce and industry of the nation depend. Every sort of community is served; every kind of railroading has its place in this vast aggregation of effort, and the variables in the problem are so multitudinous, and their nature often so profound as to daunt the courage of one who seeks to formulate them for incorporation in a general statement. Fortunately, or unfortunately, depending on the point of view, it has been my lot to have to deal with this electrification problem from both sides; at one period from the standpoint of an intimate affiliation with the development and manufacture of electrical apparatus and at another from that of one charged with official responsibility on the railroad's behalf. I am a thorough believer in the virtues of electrification, and an enthusiast about the wonders which it can accomplish, but I also have a keen appreciation of the almost infinite variations in the railroad problem, and a very wholesome respect for the dollar. I do not believe that all railroads will ever be electrified. I am not sanguine even that all the tracks of any one really big system will be so equipped in our time. It is a question of economics, and the results will not justify the expenditures even when considered with such broad vision as that which guided the Pennsylvania in spending millions to put their passenger terminal in New York City, without the prospect of a direct return. Electrification will increase the track capacity. But there are thousands of miles of railroad that have sufficient capacity now, frequently several times over, and where the wildest stretch of imagination fails to picture a future need of this kind. Electrification works wonders in suburban and interurban passenger service. I have ridden for hours across the western prairies without seeing a single town, much less a city, where these advantages would count. Electrification effects marked economies in fuel, in maintenance, in labour, and otherwise through a long list; but electrification calls for a heavy investment, and unless these economies bulk large enough, the interest on such investment will wipe them out and turn the enterprise into a losing venture. I do not believe the cause of electrification is helped by undue optimism on the part of its advocates. Rather should there be an enlightened partisanship, enthusiastic where enthusiasm is justified, but tinged with the sober conservatism of the man who has to put his own dollars to work.

There need be no discouragement to the electrical engineer in the views just given, nor to the railroad man who has looked toward the new motive power for salvation. There are so many cases where electricity should be used, where its advantages are clear and conclusive, that once the railroads escape from the financial slough of despond in which they are now wallowing, and are again able to get capital for their needs, there will not be enough engineers, there will not be enough electric factories in the country to serve them. Every big system has need of electricity somewhere. For some small roads it may mean the difference between solvency and bankruptcy. I electrified a short derelict line for the New Haven Road between Meriden and Middletown, long before given over into the one-train-a-day-annual-deficit class, and turned it into a good earner.

There can be no rule established. Generalities are sure to be misleading, but electrification is now firmly entrenched and successful. It is recognised by railroads generally as an effective agency with great possibilities, and one which is particularly valuable for certain specific purposes. Time alone will tell how broad its application is to be, but I am confident we can await developments with tranquility, assured that the art is in a healthy condition, and that progress will be along the right lines.

LEGAL.

Marconi's Wireless Telegraph Co., Ltd. *v.* The Crown.

Mr. Justice A. T. Lawrence on Friday, July 25th, delivered his award as arbitrator in the proceedings between the Marconi Wireless Telegraph Co. and the Postmaster-General.

The company claimed that it was entitled to £7,181,000. The Crown, on the other hand, contended that the damage payable to the company amounted to only about £50,000.

Mr. Justice Lawrence said: I find the amount of damages to be the sum of £590,000. I only want to say with regard to it that that is my estimate of the present worth of all the royalties the company would have received under the contract. I have excluded from consideration, as by order directed, the letter of January 21st, 1915, and I have not diminished the amount by any consideration of the probability, or otherwise, of Marconi patents being employed in commercial wireless in the future. I merely mention that in order that there may be no misunderstanding between the parties in the case of any future negotiations between them.

Sir Ed. Carson, K.C., M.P., for the Marconi Co., asked for judgment for the amount awarded.

His Lordship said that would follow.

Irish Electricity Schemes.

The Master of the Rolls, in the High Court of Ireland, Dublin, granted a petition of the Nenagh Gas Co. for the substitution of a memorandum and articles of association for an old deed of settlement, in order to convert the company into an electricity company; also for the supply of electricity for public and other purposes in the town. It was explained that the company was originally registered under the Joint Stock Companies Act, and last April it was registered as a limited company.

His Lordship allowed to stand over for the Vacation Judge an application by the Skibbereen Gas and Coke Co. for directions as to proceedings to a petition for an alteration of the memorandum of assbciation by extending the objects to the manufacture of electricity. Counsel for the company said if the petition went through soon they hoped to get ahead with the work of introducing electric light, but if there was delay until October they would not be able to start so as to provide light in the coming winter.

British Thomson-Houston Co., Ltd.

In the Chancery Division, on Friday, Mr. Justice Younger had before him a petition in the matter of this company.

Mr. Courtenay Terrell said this was a petition for the revocation of letters patent. The patent in question had been declared invalid by the House of Lords, and he understood that the company now consented to the revocation forthwith of the letters patent, with costs, certificate, and particulars of exception. Counsel said the application was purely formal, and had to follow events in the House of Lords.

His Lordship made the order.

BUSINESS NOTES.

Coal Shortage.—The *Manchester Daily Dispatch* says that the British Insulated and Helsby Cables, Ltd., Prescot, gave notice on Saturday that the works would have to close down, as from Monday, owing to coal shortage.

Export Trade to Eastern Europe.—Mr. Chamberlain states, in reply to a Parliamentary question, that the question of direct assistance to British export trade to Eastern Europe is being carefully considered by the President of the Board of Trade in consultation with banking and trading interests, but it is obvious that in the present position of our own foreign indebtedness and the state of our exchanges with the countries from which we must import food and raw materials, that the greatest circumspection has to be exercised in regard to such commitments.—*Times.*

Trouble at Ebbw Vale.—In the course of his speech at the annual meeting of the Ebbw Vale Steel and Iron Co., Ltd., on July 24th, Mr. J. W. Beynon (deputy chairman) said, referring to strike difficulties, "We have at the present moment at Ebbw Vale great difficulties with our electricians and craftsmen, and unless that trouble is settled very promptly it will be absolutely necessary to shut down your iron works and steel works for a very considerable time."

Indian Electrical Development Co.—A new company has lately been formed in Bombay with a capital of 5,000,000 Rs. and the title the Indian Electrical Development Co.

British Industrial Exhibitions in Brazil.—The British Chamber of Commerce of Sao Paulo and Southern Brazil is organising a series of exhibitions of British manufactures to be held under the direct auspices of the Council, and in the building occupied by the Chamber of Commerce. According to the *Board of Trade Journal*, each of the exhibitions will comprise one given industry, and will be open for a period of three months. These exhibitions will demonstrate in a practical manner to the local merchant and importer, the classes, types, and qualities of British goods, and will assist those manufacturers who participate in the exhibitions in getting in touch with the purchasers of their lines. All the organising, and the issue of advertising matter, &c., is being undertaken by the Chamber of Commerce; the British manufacturer has only to dispatch his supplies in the knowledge that everything connected with clearance from Customs, arranging of exhibits, dealing with visitors, &c., will be efficiently conducted by the Council of the Chamber of Commerce.

The first exhibition opens on September 1st, 1919, and the second on December 1st, 1919. The former will be devoted to the textile trades and the latter to the hardware and allied trades. Information is given in booklets which may be seen at the Department of Overseas Trade, 4, Queen Anne's Gate Buildings, Old Queen Street, S.W. 1.

The International Relations of the Thomson-Houston Interests.—The wide ramifications of the Thomson-Houston interests throughout the world render it desirable to draw attention to an important statement made in the course of the annual report of the Compagnie Française pour l'Exploitation des Procédés Thomson-Houston, which was presented at the recent general meeting. It is necessary first to recall briefly a little from history. Under the original agreements by which the founder of the French company—the Thomson-Houston International Co. and the General Electric Co.—divided their patents and rights between the various subsidiaries which they established in Europe, the Compagnie Française had to limit its activity to France, Italy, Spain, Portugal, Greece and Egypt. The absorption of the German Thomson-Houston Co. by the A.E.G., which took place in 1903, disturbed this organisation, and compelled the French company to come to terms in Italy and Spain, which, even if they had not been applied improperly by the French company's co-contractors, were to constitute a new limitation of the action of the Compagnie Française in those countries. At the annual meeting of the latter company in 1915 the directors announced their irrevocable decision to regard these conventions—with the Germany company—as null and void, and to resume their complete freedom of activity in all the countries concerned by the agreements. Since then French law of January 21st, 1918, and more recently the Peace Treaty conditions, have arrived to afford confirmation by legal means of the cancellation of the arrangements and the requisite discharge. With this object the directors of the French company have taken the necessary steps which they do not doubt will break the economic hold of the Germans.

The directors of the Compagnie Française have never failed in recent years to acknowledge the sympathy and assistance rendered to them by the General Electric Co., long before the United States entered the war. After all that has taken place since then, the question arises as to whether the American company could permit a German company to remain licensees of their rights and continue to work them in countries which are still bleeding from enemy exactions, or permit the old and respectable name of Thomson-Houston to remain coupled with their firm. On this point the report states that agreements are in course of preparation for the redistribution among the subsidiaries of the General Electric Co. in allied countries in Europe of the rights which were originally granted to the Germans, and if it would be premature for the moment to say in what form and measure this will take place, the directors remark that it is certain at least that the new arrangements will represent an expansion of the French company's rights, and of its influence in territories which have hitherto been closed to it, to say nothing of those which have been returned by the victory. The French company has already acquired control of the Société des Etablissements Carels Frères of Ghent, which undertaking is destined to become the pivot of a Thomson-Houston Belge, which in turn is to be created in co-operation with American, Belgian, and French interests.

It may be added that the General Electric Co. recently despatched a mission to the French company composed of engineers who are experts in all branches of the electrical industry, with its applications to mining, textile mills and hydro-electric works, the last branch of which is to be greatly developed in France in the near future. The success of the mission, as the chairman informed the shareholders at the Paris meeting, has exceeded all expectations, thanks to the sympathy shown between the American and the French engineers.

Lead.—In their report dated July 26th, Messrs. G. Cawson & Co. state:—"Notwithstanding the great uncertainty about coal, electrical consumers have again been buying lead freely; these works are evidently well supplied with orders, and are buying to cover their forward requirements."

Cable-Laying in Mesopotamia.—*Indian Industries and Power*, in its June issue, publishes some interesting pictures depicting the laying of the first power cables across the Tigris at Bagdad. The cables were required for conveying current for lighting, fans, and motors from the left bank of the river, where the power station is located, to the right bank. Two cables were laid, side by side, each 550 yards in one length on a drum. The cables are insulated with paper, sheathed with lead, single steel-wire armoured, braided, and served overall for a working pressure of 250 v. between the cores and neutral—*i.e.*, 500 v. across outers. The first of the cables, which were supplied to the War Office by W. T. Henley's Telegraph Works Co., London, was laid on September 28th, 1918, and the second a few days later, the position being just beneath the new south floating bridge. The cables at each shore end were laid underground, and terminated on pole structures, upon which were mounted Henley's patent bell-type outdoor terminal boxes, the cables being trifurcated at the boxes to connect to bare copper overhead mains. The work was carried out under the supervision of Capt. P. Low, O.B.E., Connaught Rangers, attached E. & M. Section, R.E.

French Electric Vehicle Business.—The Société pour l'Equipement Electrique des Vehicules (S.E.V.), of Paris, is increasing its capital from £240,000 to £360,000, with the object of greatly extending the works. The undertaking, which was established before the war by the principal motor manufacturing concerns in France, specialises on the production of magnetos and electric lighting and engine-starting sets for motor vehicles.

Correspondence with Spanish Firms.—H.M. Commercial Secretary at Madrid still receives from Spanish firms the well-known complaint of past years that British firms refuse to quote c.i.f. prices in Spanish ports. One large and influential Spanish company, which before the war had considerable relations with Germany, and is now endeavouring to trade with the United Kingdom, quotes the case of a British firm paying no attention to repeated requests for quotations c.i.f. Spanish port or even c.i.f. Gibraltar, prices being given f.o.b. Hull, which to the company in question was useless. The Spanish company was even still more upset by the last paragraph of a letter which was worded as follows:—"We shall be glad if in future you will correspond in English, French, or German." This was interpreted by the company to mean:—"We hope you will be good enough to use any language in the world except Spanish." The Spanish company would not in the least mind being asked to correspond in English, being the language of the writer of the letter, but is naturally offended if asked to use the language of a third nation, which is the language neither of the writer nor of the recipient. If British firms would endeavour to correspond in Spanish, even if it resulted in slight delay in the transmission of their post, it would certainly, in the long run, turn out to their material advantage.—*Board of Trade Journal.*

German Import Organisation.—According to a wireless dispatch from Berlin to *The Times*, German Foreign Trade Departments are to be established by the Ministry of Economics in the various industrial districts of Germany for the purpose of regulating the importation and distribution of foreign goods, especially raw materials. Representatives of manufacturers, merchants, and consumers will participate in the management of these departments, at the head of which will be nominees of the Ministry of Foreign Affairs, with the approval of the representatives of commerce and industry.

The Termination of the War.—The General Purposes Committee of the L.C.C. recently reported in the following terms:—

"The Council has passed a number of resolutions chiefly dealing with questions of war wages and war bonus, of which the operation has been limited to one or other of three periods—six months after the declaration of peace, three months after the declaration of peace, or the duration of the war. In view of the probable ratification of the Peace Treaty at an early date, we consider it advisable that the Council should pass a general resolution defining the meaning of 'the duration of the war' as six months after the declaration of peace, and extending the period of three months after the declaration of peace to six months thereafter. The object of our recommendation is two-fold—(1) That no question should be prejudiced by the sudden cessation of the operation of the Council's resolutions during or immediately after the recess, and (2) that all questions should have the same time for consideration. We have communicated our proposal to the Education and Asylums and Mental Deficiency Committees, and we recommend that, for the purposes of resolutions of the Council, the operation of which has been limited to the duration of the war or to a period of three months after the declaration of peace, the meaning of the term 'duration of the war' be defined as six months after the declaration of peace, and the period of three months after the declaration of peace be extended to six months thereafter."

Holidays.—The works and offices of the General Electric Co., Ltd., at Witton, Birmingham, will be closed for the holidays from this (Friday) evening, August 1st, until the morning of Monday, August 11th.

The offices and works of the Lancashire Dynamo and Motor Co., Ltd., at Trafford Park, Manchester, are closed from to-day (Friday evening) until the morning of Monday, August 11th, for the annual summer holidays.

The works and offices of the Benjamin Electric, Ltd., will be closed during next week for the annual holidays.

For Sale.—Two 230-volt D.C. armatures are offered for sale by the Visitors of the County Asylum, Rainhill. See our advertisement pages to-day.

Auction Sale.—By direction of the Expeditionary Force Canteens (A.S.C), Messrs. Harris & Gillow will sell by auction, on August 13th and 14th, at 143, Charing Cross Road, W. 1, a valuable and practically new kinematograph equipment. For particulars see advertisement pages to-day.

Liquidations and Dissolutions.—British Accumulator Co., Ltd.—Winding up voluntarily. Liquidator, Mr. E. B. Rawlinson, Tanfield Buildings, Bradford.

Enfield Electric Cable Manufacturing Co., Ltd.—Claims by September 8th, to the liquidator, Mr. W. L. Smith, Cable Works, Brimsdown.

Tundley & Marron, nautical instrument makers and electrical engineers, 158, Dock Street, and 35, Adelaide Street, Fleetwood.—Major P. Tundley and Mr. J. H. Marron have dissolved partnership, the latter having retired. Debts will be attended to by Major P. Tundley, who will continue the business in his own name.

Veritys Founders, Ltd.—Winding up voluntarily, with Mr. C. J. Pitt, Plume Works, Aston, as liquidator. Meeting of creditors, August 6th.

Annual Outing.—On July 23rd, Venner Time Switches, Ltd., combined the celebration of Peace with the annual outing, and invited the men to bring their wives. The firm make a practice of bearing the cost of these outings. The party proceeded by motor vehicles through some of the most delightful parts of Surrey—Reigate, Dorking, Godalming, Hindhead, and home *viâ* Guildford and the Portsmouth Road. The time schedule allowed for a refreshing stop on both the outward and homeward journeys, also halts at places of exceptional beauty such as Reigate Hill and the Devil's Punch Bowl. Chocolates and cigarettes to last the day were handed round at the first halt. In the course of the brief speechmaking Mr. Jennings referred to the pleasure felt by all in the safe return of Mr. Sharp from France, and the spontaneous vocal honours rendered to Mr. Graseby fully backed up what was said in proposing the toast of "The Firm." A vote of thanks was passed to the stewards—Miss Glaysher, and Messrs. White, J. Maydwell and Lane.

New French Customs Duties.—By a French Presidential Decree of July 8th the Customs duties leviable on a large number of manufactured goods on importation into France and Algeria were increased. For this purpose, for each category of goods specified in the tariff, a "coefficient" or multiplier was fixed representing the relation between the values of the goods in 1913 and in 1918, according to the official valuations laid down for those years by the Permanent Commission on Customs Values. The present rates of duty are, therefore, the specific rates contained in the pre-war tariff multiplied by "the coefficient" (varying from 1·1 to 3) attributed to the class of article concerned. A Parliamentary Return, entitled "France and Algeria: Increase of Customs Duties," which has been published by the Board of Trade, contains a translation of the Decree and of the Ministerial Report, explaining its nature and object, together with a statement showing in detail the French tariff rates of duty on the articles affected by the increased duties and the "coefficient" or multiplier established in each case. Copies of the Return may be purchased (9d. plus postage) either directly or through any bookseller, from the sale depôts of His Majesty's Stationery Office. In ordering copies, the reference number "C.M.D. 273" should be quoted.

Catalogues and Lists.—Messrs. Strode & Co., Ltd., 48, Osnaburgh Street, London.—Illustrated price leaflet of commemorative statuettes.

Messrs. E. Bennis & Co., Ltd., 28, Victoria Street, London, S.W. 1.—12-page catalogue containing a profusely-illustrated description of their self-cleaning compressed-air furnace arranged for hand-firing.

Messrs. Hamilton, Foulds & Co., 187, St. Vincent Street, Glasgow.—New price list of semi-enclosed and totally-enclosed types of W. H. ironclad motor starters, which are made at their works in Douglas Street, Glasgow, where the firm are at present concentrating on standardisation of these two types. Some of the special features of the apparatus are indicated, and names of places where they are installed are given.

Jacques Boyer, 5 bis, Rue St. Paul, Paris.—Supplement to catalogue of documentary photographs.

General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C. 4.—Illustrated and priced circular (four pages), No. L 2,239, giving full particulars relating to the "Witton" Carsak cell.

Erith Engineering Co., Ltd., 70, Gracechurch Street, London, E.C.—16-page illustrated catalogue devoted to the Erith-Riley self-cleaning underfeed stokers for land and sea service. Construction matters, clinker action, overload capacity, fluctuating loads, and other points are touched upon, and an account is given of the large stokers of the type employed at the Bow power station of the Charing Cross Electricity Supply Co.

Book Notices.—*British Shipbuilding.*—A finely illustrated issue of a couple of hundred pages, containing many articles on shipbuilding design, construction, and equipment; also descriptions of the works and operations of many of the leading companies and firms engaged in this vast British industry. The issue contains a host of advertisements, and the whole, from cover to cover, is printed on art paper. It is published by the Syren and Shipping, Ltd., at 91 and 93, Leadenhall Street, London, E.C., at 5s. net.

"Science Abstracts." No. 258, Sections A and B. London: E. & F. N. Spon, Ltd. Price 1s. 6d. each.

"Electric Arc Cutting and Welding by Alternating Current: Instructions for Setting-up and Operating the A.C. Cutting and Welding Machine and Electrodes." London: A.S. Cutting and Welding Co., Ltd. Pp. 90, figs. 95. Price 5s.

"Post Office Electrical Engineers' Journal." Vol. XII, Part 2. July, 1919. London: Electrical Review, Ltd. Price 1s. net.

"Memoirs of the College of Science, Kyoto Imperial University." Vol. III, Nos. 5 to 10. Kyoto: Maruzen Co., Ltd.

"Storage Battery Practice." By R. Rankin. London: Sir Isaac Pitman & Sons, Ltd. Price 7s. 6d. net.

"Electric Mining Machinery." By S. F. Walker. London: Sir Isaac Pitman & Sons, Ltd. Price 12s. 6d. net.

Trade Announcements.—Messrs. Mayall & Co., Ltd., electrical factors, have removed to 23-24, Lincoln's Inn, Corporation Street, Birmingham. Manufacturers are asked to forward latest lists there.

Messrs. Renshaw & Marsden are opening new premises in Penny Street, Blackburn, as electrical engineers and general hardware dealers.

MESSRS. MAITLAND & CO., electrical engineers, have changed their address to Werneth Chambers, 29, Princess Street, Manchester. Telephone number unaltered.

Mr. James Brotherton has commenced business as the CABLE ELECTRIC CO., electrical engineer, at 14, Ivegate, Colne, Lancs. Catalogues of lighting and power accessories and country house lighting sets are desired.

MESSRS. FRIEND & SON, electrical engineers and factors, are moving their offices and showrooms from Avenue Road to 133, High Street, Ilfracombe. They desire to receive catalogues from manufacturers of complete lighting units, telephones, bells, and accessories.

LIGHTING AND POWER NOTES.

Athy.—E.L. SCHEME.—The U.D.C.'s scheme will provide about 50 lamps of 50 C.P. for public lighting. It is estimated that 300 private users can be secured.

Australia.—SYDNEY, N.S.W.—The Municipal Council is to purchase one 8,000-KW. turbo-alternator, complete with condenser and air filter, from the British Westinghouse E. & M. Co. The price is to be £59,500, f.o.b. Manchester. The freight, insurance and war risk are to be paid by the company on the Council's behalf, and the company to invoice the Council with the net cost to it of these items, plus 5 per cent. for handling. Duty charges are to be paid by the Council in Sydney. Erection is to be carried out by the company, and the company is to invoice the Council for the same on the basis of net cost plus 10 per cent. Acceptance on the company's part is made subject to it not interfering in any way with work on the two 12,000-KW. sets, but with a proviso regarding the price, which in April last was stated to be £140,000. The company guarantees that work on the 12,000-KW. machines will not in any way interfere with the work on this 8,000-KW. set, which is more urgently required. The company is to receive 90 per cent. of the f.o.b. value, to be paid in Sydney on the plant being shipped; 5 per cent. to be paid on the erection of the machine, and the remaining 5 per cent. to be held over the usual maintenance period of 12 months, but in any case, to be paid not later than 12 months after the second payment. Subject to the above points, the company guarantees to have the machine delivered and erected by May 1st, 1920, under a penalty and bonus as follows:—If the company has the machine ready before May 1st, 1920, it is to receive an extra £200 per week; and if the company fails to have the machine ready before the above date, it agrees to the Council deducting £150 per week from the price. The above penalty not to exceed £750, and bonus not to exceed £1,000, in any case. It is also recommended that two 1,000-KW. rotary converters be purchased, and Messrs. Preece, Cardew, Snell & Rider be instructed by cable to order such rotary converters at the lowest possible price, these converters to be delivered in ample time before the winter of 1920.

Aylesbury.—NEW SERVICES.—The T.C. is to take steps to get owners and tenants of houses to come to an amicable arrangement for the installation of electric light in new dwellings. The Council will give such applications priority, and endeavour to supply three lights for 6d. per week, plus 20 per cent. additional cost of production.

Bacup.—PROPOSED LOAN.—The T.C. is to make application to the M.H. for sanction to borrow £12,000 for extensions to the electricity undertaking.

Barrow.—YEAR'S WORKING.—For the year ending March 31st the electricity accounts showed a loss of £2,400. It was said that there had not been an opportunity of re-considering the charges for energy, but it was hoped that coming recommendations would be supported. A 30 per cent. increase over pre-war rates is to be asked for. The reason for the loss on the year's working was really found in the payment of interest on, and redemption of, capital. The gross profit was £12,000, and liabilities were £14,000. An increase of 5 to 10 per cent. on present charges would enable them to work satisfactorily.

Bath.—NEW PLANT.—A report has been prepared which recommends the purchase and installation of a turbo-generator with all accessories, and application to the M.H. for sanction to borrow £30,405, the cost of the generator and accessories being £22,441, without the buildings, &c., necessary. The report states that the electricity undertaking has now reached a point at which it is necessary that additional plant should be installed, while it may be possible, so far as can be seen, to go through next winter, notwithstanding the extremely small margin of safety. From the point of view of economic generation and economy in space and upkeep, the Ljungstrom turbo-generator is the unit which should be installed. Apart from the economy in coal consumption, much of the economy effected in other stations is obtained by labour-saving devices which it would be impossible to install on the present site. This fact raises the question as to the desirability of removing the generating station, to which matter a Sub-Committee is devoting attention at the present time; but it would not be possible to carry out the scheme in time to deal with the increased load which is anticipated in 1920. The turbo-generator is of a type that can be dismantled and re-erected at a reasonable cost. L.G.B. sanction to borrow £2,528 for the renewals and extensions of electric mains has been received. The consumers' obligation to pay the whole cost of the service in the case of new electricity connections, which operated during the war, has now ceased, but the Committee has decided to enforce such charges as the E.L. Order entitles the Corporation to make.

Batley.—PRICE INCREASE.—The charges for electricity are to be further increased, as from September 1st, by 20 per cent. (making 75 per cent. on pre-war rates) for lighting, and by 25 per cent. (making 100 per cent. on pre-war rates) for power and heating.

Bradford.—PROPOSED PRICE INCREASE.—The Electricity Committee recommends an increase in charges for energy for lighting, heating, and domestic uses by a further 30 per cent., which makes an increase of 50 per cent. on pre-war rates. This increase will not affect power users, whose rates vary automatically with the price of coal.

Bury.—PROPOSED LOAN.—The Cleansing Committee has decided to recommend the T.C. to apply to the M. of H. for sanction to borrow money for the provision of an electric driving plant in connection with the machinery at the town's yard.

PRICE INCREASE.—The charges for electricity are to be increased by 10 per cent. for tramways and lighting, and 20 per cent. for power purposes, the new prices to operate from October 1st.

Chepstow.—STRIKE.—As a consequence of a strike of electricians at the shipyard, the members of the Amalgamated Society of Engineers in the district have been called out.

Chiswick.—PRICE REVISION.—The Electric Supply Corporation, Ltd., has notified its intention to charge 2½d. per unit, instead of 1½d., plus 40 per cent. for power.

Continental.—NORWAY.—The *Financial Times* reports that the new power station of Raanaasfos, at Blaker, when completed, will be able to supply 72,000 H.P., which will amply cover the district's need of electrical power. The total cost is estimated at Kr. 25 million. Preparatory work began in March, 1918, and in December the actual damming was started. The dam will be the largest in Norway, with a depth of water of 120 metres. There will be six turbines in the power station of 12,000 H.P. each. The daily power output will not be 72,000 H.P. all the year round, but may drop to 50,000, as there is not much water during the winter, and in summer, when timber is floated, the sections will all be lowered and the height of the waterfall reduced. The first building for the installation of three turbines will be ready in 1921.

Crompton.—PROV. ORDER.—Crompton, Royton, and Lees Urban District Councils, acting together, recently applied for an Electricity Supply Order providing for the supply of energy for those districts by the Oldham Corporation. The Board of Trade has replied that it is not prepared to entertain the application pending the decision of Parliament in regard to the Electricity (Supply) Bill.

Croydon.—GAS AND ELECTRICITY.—The electrical engineer (Mr. A. C. Cramb) has received an application from Croydon Gas Co. for a supply of electricity to drive a 250-H.P. compressor plant. The company pays the cost of laying the necessary main (£1,000), subject to certain conditions which have been agreed upon.

Dronfield.—PROV. ORDER.—The U.D.C. has decided to support the application of the Sheffield Corporation for a prov. order to supply E.L. in the Council's area.

Edinburgh.—PRICE INCREASE.—From October 1st the lighting rate is to be increased ½d. per unit, making the charge 4d. per unit; and for power by ½d., making it 1½d. A slight increase in the charge for traction and for public lighting is also to be made.

Great Harwood.—TIME EXTENSIONS.—The B. of T. has extended the E.L. Order for another six months, and the U.D.C. has decided to renew the application for a further extension.

Harrogate.—A branch of the Bradford textile industry is about to be established at Pannal, Harrogate, and the factory will be entirely electrically driven. The venture is by Mr. F. Gascoigne Johnson, head of Messrs. Ward, Andrews, Johnson and Co., dress goods manufacturers, Bradford.

Heston and Isleworth.—BULK SUPPLY.—Last May the U.D.C. instructed the Electricity Committee to arrange the terms of an agreement with the Twickenham and Teddington E.L. Co. "for a bulk supply of H.T. energy at the Council's electricity station, on the basis that the Council undertake to receive a minimum quantity of 400,000 units per annum for a term of three years at the price of £4 per KW. of maximum demand and 0·9d. per unit supplied, in addition to 10 per cent. per annum on the cost of the feeder cable between the Supply Co.'s generating station and the point where it enters the Council's district, the price per unit being based on coal at 25s. per ton, and being subject to a sliding scale in respect of the cost of coal and labour." The Committee now reports that it has had the draft of an agreement, which provides that the minimum supply mentioned above is to be taken for a period of seven years, but that either the company or the Council may at the end of three years require the price to be revised, and that, failing agreement as to the new price, the matter is to be submitted to arbitration.

Heywood.—YEAR'S WORKING.—The Corporation electricity department shows for the past year, total income £10,383, an increase of £1,571. Average price obtained per unit sold, 1·67d., against 1·53d. Debit balance on the year's working, £291, against a debit balance of £741 on the previous year. Units generated and purchased, 1,613,034; sold, 1,404,229. The maxi-

mum load recorded was 685 KW., an increase of 70 KW. Consumers increased by 3 to 356. Total works cost per unit sold at Heywood, 1·24d.

Hornsey.—PRICE INCREASE.—The price of electricity is to be raised another 20 per cent. in September, making 80 per above pre-war charges.

Hull. — PROPOSED PRICE INCREASE. — The acting engineer (Mr. Magoris) states that the present increase of 6s. per ton on coal, would necessitate an extra annual expenditure of £17,000. In addition, the 47-hours' week and other awards would entail a further outlay of £5,000 per annum, while contingencies due to the coal strike would represent at a minimum, £1,565. He recommended that the tariff for flat rate lighting be increased by 1d. per unit, and that an increase of 32½ per cent. apply to other units. The total increase above pre-war prices under this arrangement would be 2¾d. for flat rate lighting, or 68 per cent., and for other purposes, 100 per cent. The recommendations were adopted.

Ilford. — STRIKE. — The municipal workers, including those at the electricity works and tramway sheds, struck work on Friday last week. The cause of the trouble is the refusal of the Council to pay overtime rates for all hours worked beyond 47 per week since the last day in May, but it agrees to pay ordinary rates for the extra hours worked. Several workshops and factories had to close down owing to lack of electricity, and the tramcars stopped running on Friday. The strike ended on Monday night, the Council having conceded the men's demands.

Knottingley.—TIME EXTENSION.—The Board of Trade has extended the E.L. Order, 1914, for a further six months.

Lichfield.—PROV. ORDER.—The Rugeley Gas Co. has notified the R.D.C. of its intention to apply to the B. of T. for a prov. order to supply E.L. within the area of the Council.

Lighting Restricted. — Owing to the Yorkshire coal strike, restrictions have been placed upon the supply of electricity in several Northern cities. At Leeds the electricity works are to observe a five-days' week; street lighting is restricted to the centre of the city, and the amount of illumination rigidly curtailed. Nottingham is without street lighting, and at Bradford street lighting is being reduced by half, while at Sheffield lighting is also being reduced. Derby has returned to war conditions so far as street lighting is concerned.

London.—COST OF STREET LIGHTING.—The City of London's street lighting for the year ending March 31st last cost £20,875.

LOAN SANCTION.—The L.C.C. Finance Committee recommends the sanction of the Council to the borrowing of £14,286 by the St. Pancras B.C. for steel work for completion of boiler house and coal-handling plant, completion of coal conveyor, circulating-water pumps, and storage battery; and of £81,000 by the Woolwich B.C. for boilers and steam piping, 5,000-KW. turbo-generator and accessories, two 500-motor converters, three converter panels, one 25-ton travelling crane, the necessary river work, building works, and for acquisition of site.

Matlock.—PROV. ORDER.—The Nottingham E.S. Co. has informed the U.D.C. that it is applying for a prov. order to supply electricity.

Northampton.—PRICE INCREASE.—The E.L. & P. Co announces that the tariff for energy will be increased as from July 24th by a further 30 per cent. for power and by 5 per cent. for lighting and domestic heating, the respective increases being 10 and 1 per cent.

MAINS EXTENSIONS.—The E.L. and P. Co. applied to the Northants C.C. for consent to lay mains in order to supply electricity from its new works at Northampton to various places in the Wellingborough, Rushden, Higham Ferrers, and Irthlingborough districts. Consent was given, subject to certain conditions, which included a provision that the mains should be laid in the grass roadside borders or in the footpaths, and that no main should be in the carriage-way, except where it is necessary to cross the roads. Another clause provided for mains on one side of the road only.

Sheerness. — STREET LIGHTING. — The U.D.C. has decided to pay a further increase of 15 per cent., making the war-time advance 40 per cent., to the E.P. and Traction Co., for street lighting, as from July 1st last.

Southampton.—STRIKE.—Municipal workers, including electricity works and tramway employés struck work on Monday. Naval ratings were called in to work the sewage pumps. The Corporation has offered to concede the 5s. per week increase demanded, subject to resumption of work at the usual time on Wednesday.

Swindon.—NEW SERVICES.—The T.C. has decided to adopt the overhead system for supplying energy to the workmen's dwellings to be erected at Hurst, the estimated cost, exclusive of mains, &c., for distribution, but including services for the first 24 houses, is £7,654. A new feeder, to cost £1,270, is to be provided to supply energy for power at the factory of the Gerrard Engineering Co., and to provide a supply to the new secondary school and for the development of the Rolleston estate.

Tasmania.—GREAT LAKE SCHEME.—According to the daily Press, it was stated in a speech from the Throne in the Tasmanian Parliament, that the State hydro-electric undertaking had realised the most sanguine expectations, and extensions were proceeding to increase the capacity of the power output of the Great Lake scheme to 40,000 H.P. The electrolytic zinc works were steadily progressing, and the company had launched a largely extended scheme involving the expenditure of £750,000. Investigations for further water-power resources were continuing actively. The last financial year showed an increase of £78,000 over the previous year's revenue.

Taunton.—PROPOSED PRICE INCREASE.—The T.C. has applied to the B. of T. for an order to increase the maximum charge for electricity from 8d. to 1s. per unit.

Walthamstow.—M.H. INQUIRY.—An unopposed M.H. inquiry was held last week into the application of the U.D.C. for a loan of £32,975 for additional electrical plant.

York.—WATER POWER.—With the object of utilising the property for generating electricity by water power, the T.C. has agreed to lease the mill, weir, and water power at Stamford Bridge for 25 years, at an annual rental of £66, and with an option to purchase for £1,700.

TRAMWAY AND RAILWAY NOTES.

Ashton.—WAGES.—Application is being made on behalf of all the tramway workers of the Ashton-in-Lyne Corporation, the Stalybridge, Hyde, Mossley, and Dukinfield Joint Boards, and the Oldham, Ashton, and Hyde Co.'s services, for an increase of 12s. per week in wages. It is a flat rate intended to apply equally to drivers, guards, and shedmen, and to women as well as to men.

Ayr.—NEW CARS.—The T.C. has decided to purchase four new tramcars at £2,350 each.

Barrow.—PURCHASE.—The Town Council is to give notice to the British Electric Traction Co. that it wished to negotiate for the purchase of the electric car service of the borough, according to the agreement existing between the company and the Corporation.

Burnley.—ACCIDENT.—On Monday the main steam pipe burst in the boiler house at the electricity works. All the running plant had to be shut down, and this caused a general stoppage of the cars. Temporary repairs were effected, and the electricity supply was restored after about two hours.

Coventry.—YEAR'S WORKING.—The annual report on the working of the Corporation electric tramways shows receipts for the year amounting to £80,614, compared with £71,802 the previous year. The working expenses amounted to £59,289, compared with £46,717; traffic expenses increased by £5,261, of which £3,324 was wages. The electricity used amounted to 1,606,187 units, of which 214,820 were purchased from the electricity department and the remainder generated at the power station. During the year 965,311 car-miles were run, a decrease of 35,310 on the previous year. The total number of passengers carried was 15,747,289, an increase of 309,911.

PROPOSED EXTENSIONS.—The Tramways Committee recommends that Parliamentary powers be sought for the construction of new tramways from Broadgate to Hales Street, and from Burges to Fleet Street, and for other connecting lines.

Croydon.—EXTENSION POSTPONED.—On account of the cost (£39,908), the T.C. has decided to defer, for the present, the proposed extension of the tramway at the Addington terminus to Spring Lane for a distance of 1,140 yards.

Doncaster.—PROPOSED LOAN.—Application is to be made for sanction to borrow £26,000, £21,000 of which is to be devoted to the purchase of ten new tramcars and the other £5,000 to the erection of a new tramcar shed in Grey Friars Road.

COAL STRIKE.—Owing to the coal strike, the tramway service was suspended during Sunday, July 20th, and it was announced that the service would be suspended on Saturday, July 26th, until further notice, which would enable the local authority to carry on its supply of electricity for lighting and industry for six weeks if no further coal were obtained.

Edinburgh.—WOMEN CONDUCTORS.—Edinburgh Tramways Committee received a deputation last week from various women's societies with regard to the employment of women as tramway conductors. They assented to the position that the men who went to the war should be reinstated, and also that preference should be given to demobilised and discharged men. When these had been provided for, the service is to be open to both sexes.

EXTENSIONS.—A sub-committee's recommendations that application be made for authority to construct tramway extensions, and also for authority to run motor-omnibuses on any route within 5 miles of the city boundary has been approved.

East Ham.—LOAN SANCTION.—The T.C. has received sanction to a loan of £23,065 for the reconstruction of the tramway track in the Romford Road.

Halifax.—Extensions.—The Tramways Committee has decided to proceed with the extension of the tramways from West Vale to Stainland.

Heywood.—Year's Working.—During the past year's working of the tramways the net profit was £944. The receipts per car-mile were 17·63d., an increase of 25 per cent. over the previous year. The increase on power expenses was £592. Fare receipts were £19,394 (including parcels), an increase of 3·60d. per car-mile, representing a sum of £4,053. The car-miles run were 25,794,862, against 26,090,380 in 1918; passengers carried, 3,130,696, against 2,982,696; units used, 433,855, against 427,510; units per car-mile, 1·67, against 1·63 in 1918. The increase in the ordinary passengers carried was 169,717.

Ilford.—New Cars.—The Council is paying £2,000 each for tramway cars.

Lancaster.—Tramway Track.—The T.C. reports that immediate expenditure of £4,000 is necessary to put the tram-track in order, and in view of a prospective deficit equal to 6d. in the £ on the rates, the question of substituting electric 'buses for tram cars should be considered. A Committee was appointed.

Leeds.—Sale of Cars.—The Corporation has sold to the Yorkshire (West Riding) Electric Tramway Co., eight cars at about £900 per car. The Tramways Committee is also negotiating with the Walthamstow U.D.C. for the sale of six cars not required for future use.

Time Extension.—The B. of T. has extended the time for the completion of tramway No. 2 (1914 Act) by a further year.

London.—Tramcar Fire.—An L.C.C. tramcar caught fire on Wednesday, last week, in Evelyn Street, Deptford. No one was injured.

L.C.C. Bill Withdrawn.—The L.C.C. Tramways Improvements Bill, which was opposed by several London M.P.'s, has been withdrawn.

Acton.—The bridge over the North London Railway at High Street is to be widened, and a new station provided.

L.U.T. Track Reconstruction.—Nearly £150,000 is to be spent on reconstructing the Acton, Ealing, and Hounslow tramway system, and new cars are to cost £2,500 each.

The tramway track in the Hanwell district will not be relaid for a year.

The L.C.C. is to apply in the next session of Parliament for relief from the liability for the maintenance of the surface of the roadway in thoroughfares in which tramways are worked, or may hereafter be worked, with the exception of any rails or other works which may be used for the purpose of the tramways, and, further, to decide that no part of the cost of street improvements be charged to the tramway account, except in the case of improvements which are solely and specifically required for the working of its tramway system.

St. Margaret's Bay (Kent).—It was reported at the last meeting of the Dover T.C. that the time limit of the Dover, St. Margaret's, and Martin Mill Light Railway Order, 1909, expired in August, and that no notice of application for an extension had been received.

Service Restrictions.—Owing to the Yorkshire coal strikes, tramway services have been curtailed in several Northern cities. Doncaster tramway cars stopped running on Saturday; Sheffield services have been cut down, and at Hull tramways are to run only five hours per day, and the all-night and Sunday services suspended. At Derby the cars stop running half an hour earlier on week days, and are entirely suspended on Sundays.

Walthamstow.—Open-deck Cars.—The tramway manager has had a notice from the Police Commissioner that in future open-deck tramcars will not be licensed unless upper-deck seats are provided with suitable waterproof knee aprons.

West Ham.—Pay Lost Whilst Off Duty.—During the hearing of an assault case on Monday, it was stated that a tramway conductor was hit without reason, and had to be medically attended. The car was out of action for six hours, with the result that the conductor would lose 27s. 6d. in wages. The magistrate questioned whether a man knocked out in the course of his employment would lose his wages, but Mr. Shearman (prosecuting) said he understood that was the case.

Worcester.—Proposed Fare Increase.—The National Federation of Transport Workers has agreed to support the Tramway Co. in its application to the City Council for permission to increase the fares by 50 per cent.

TELEGRAPH AND TELEPHONE NOTES.

Atlantic Cable.—A Government cable is now in operation between this country and Canada. All telegrams for Australia and New Zealand handed in at post offices are forwarded by this cable to Canada for transmission by the State-owned Pacific cable, unless they are specially marked by the senders to be sent by another route. Telegrams for Canada and the West Indies which are handed in at post offices, marked *via* Imperial," are also sent by the cable. The charges are the same as in the case of the other Atlantic cables. Where this cable came from is easily guessed.

Baudot System.—The application of the Baudot installation to Post Office telegraph systems has recently been started on the London-Dublin service, giving a total of eight channels—four either way—each working at a speed of 30 words per minute, says the *Times*.

Cable Landing Rights.—In the House of Commons last week, Lieut.-Colonel Archer-Shee asked the Postmaster-General whether the American Telephone and Telegraph Co. had been granted landing rights on both sides of the Atlantic for the five Atlantic cables which it took over from British companies before the war; and, if so, upon what date were these landing rights awarded? Mr. Pike Pease said: The company was promised landing rights under certain conditions when it took over the five trans-Atlantic cables in question. There had been considerable delay in issuing a formal licence embodying these landing rights, but such a licence had recently been completed.

Egypt.—Two large Government wireless stations, which it is hoped to complete before April next, are, according to the daily Press, situated at Leafield, near Orford, Suffolk, and near Cairo, Egypt, to establish direct communication between England and Egypt. The cost is stated to be £393,220, instead of £223,220 originally estimated.

France.—Telephonic communication throughout France was restored on July 24th, except with Alsace-Lorraine.

Telephone Inefficiency.—The present unsatisfactory state of the telephone system of the country was strongly criticised at a conference last week arranged by the National Union of Manufacturers (Inc.). Many instances showing how business is seriously interfered with by telephone delays were given. According to the *Times*, the following resolution was carried unanimously:—"That this meeting requests the Postmaster-General to receive a deputation to present to him certain facts relating to the present condition of the telephone service, and to urge upon him the desirability of accepting a small committee of business men with whom he can confer, the object being to assist him in reorganising the present telephone system, and in bringing it to a state of business efficiency."

United States.—Uncensored wireless communication between America and Nauern, Germany, commenced on July 24th, when a number of commercial messages were sent.

The cable censorship exercised by the Navy Department during the war ceased on July 24th, when the New York office of the censor, which handled 85 per cent. of the cable traffic between Europe and the greater part of North America, was closed.

Mr. Daniels, Secretary for the Navy, has asked Congress to enact legislation to permit the Navy Department to handle commercial wireless messages, on the ground that "an intolerable situation in the business world is threatened because of the inadequacy of other systems of international communication."

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Sydney.—August 27th. N.S.W. Railways and Tramways Department. Three-phase induction motors. Chief Electrical Engineer, 61, Hunter Street, Sydney.—*Tenders.*

September 10th. N.S.W. Railways and Tramways Department. D.C. motors. Chief Electrical Engineer, 61, Hunter Street, Sydney.

Melbourne.—August 27th. Secretary for Railways. Electric capstan for Newport power house (contract No. 32,381). Local representation."

Victoria.—August 19th. P.M.G.'s Department. Supply of detectors. (July 18th.)

Belfast.—August 2nd. Tramways Committee. 20 to 50 double-deck top-covered cars, complete with trucks and electrical equipment. (July 18th.)

Bradford.—August 15th. Corporation Electricity Department. Three water-tube boilers, superheaters, stokers, &c., natural draught chimney-type cooling tower. (July 25th.)

France.—Paris.—September 2nd. Administration des Chemins de fer de l'Etat. Electrical equipment of a sub-station of the Bellevue Funiculaire. Particulars, Bureaux du Service électrique (2e division), 43, Rue de Rome, Paris.

Grimsby.—August 11th. Electricity Department. Piping, electrically-driven pump, and tank. (July 18th.)

New Zealand.—Dunedin.—August 6th. City Council. One 3,500-volt three-phase regulator. Five per cent. deposit."

Redditch.—August 10th. U.D.C. A lightning conductor at the electricity works. G. W. Hobson, Clerk to the Council.

Rhyl.—August 7th. U.D.C. Electricity Department. Accumulators. (July 25th.)

Torquay.—B.C. Electricity Department. Second-hand Lancaster boiler or other suitable oil-fuel tank. (See this issue.)

Wigan.—August 2nd. Guardians. 16-KW. steam dynamo, battery, wiring and fittings, &c., for the Poor Law Infirmary, Billinge. (July 18th.)

*A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development and Intelligence), London.

CLOSED.

Australia.—MELBOURNE.—City Council. Accepted :—
One 5,000-KW. frequency changer, £°2,320.—Australian General Electric Co.
H.T. switchgear, £10,561.—British Westinghouse E. & M. Co.
1,050 condenser tubes, £482.—Knox, Schlapp & Co.

SYDNEY.—Metropolitan Board of Water Supply and Sewerage :—
Electrical sundries for 12 months.—Lawrence & Hanson Elecl. Co., Ltd.

N.S.W.—Public Works Department :—
Electric goods lift for the Sydney University, £950.—Standard-Waygood Hercules, Ltd.
Electrical illuminations in connection with peace celebrations, £785.—Lawrence & Hanson Electrical Co., Ltd.; Hanley & Page, £70.—*Tenders.*

Aylesbury.—T.C. :—
Cable.—Johnson & Phillips, Ltd.

Barrow.—T.C. :—
150-K.V.A. transformer, £261.—British Electric Transformer Co., Ltd.
Switchgear, £305.—Ferguson, Pailin & Co.

Harton and Whitburn.—The Grange Iron Co., Ltd., have secured a contract for two 150-H.P. electrical haulage plants for the Harton and Whitburn collieries.

Norway.—It is reported from Christiania that the State Railway Authorities have just accepted an offer from the A.S. Norsk Elektrisk & Brown Boveri, the Norsk Maskindustri A.S., and the A.S. Per Kure for the Electrification of the Drammen railway. The Norwegian offer was successful in competition with many foreign tenders for the work.

FORTHCOMING EVENT.

British Scientific Products Exhibition, Central Hall, Westminster.—Open daily 11 a.m. to 7 p.m.; Saturdays 12 noon to 9 p.m.; closes August 5th.

NOTES.

Telephone Extensions.—The principal item in the P.O. scheme of telephone improvements, said the *Manchester Guardian* recently, would be the provision of new underground trunk lines from London to Manchester, passing Northampton, Leicester, Loughborough, and Derby. From Derby a line would run to Nottingham, and there would be a new cable from Derby to Sheffield and Leeds. Contracts had been placed for certain underground cables between Liverpool and Manchester, Liverpool and Chester, Leeds and Wakefield, Manchester and Bolton, and Manchester and Rochdale. Eight underground telephone lines would be begun during the year—London to Bristol, London to Southampton, Loughborough to Nottingham, Derby to Nottingham, Hull to Grimsby, Leeds to Harrogate, Leeds to York, and Paisley to Greenock. In addition 140 overhead circuits would be provided. Contracts had been placed for new duct lines, to be subsequently cabled, from Ormskirk to Preston, and Rawtenstall to Bacup. A sum of about £250,000 was being spent in laying underground cables in over 20 towns, including Saltburn, Lincoln, Grimsby, Dewsbury, Ashton-under-Lyne, Eccles, Accrington, Stroud, Newcastle (Staffordshire), Malvern, Mansfield, Nottingham, Chesterfield, Market Harborough, Sheffield, Shrewsbury, and some smaller places. A new switchboard was being provided for the central exchange, Liverpool, and extensions at the bank exchange, Liverpool, and at Derby and Leeds. There would be extensions of all existing exchanges (switchboards and apparatus) at Lincoln, Cambridge, Birmingham North, and Hove. The building programme for the provinces this year included eight new exchanges, which would be at Grantham, Lancaster, Southport, Northampton, Preston, and elsewhere; and extensions to seven existing exchanges at Burnley, Fleetwood, and Wigan, and other towns.

Electric Vehicle Statistics.—We have received the following statistics, relative to the running of a G.V. 3½-ton electric vehicle for the 12 months ending March last, from Mr. W. A. Walker, electrical engineer to the Kettering U.D.C., who informs us that never to his knowledge has the vehicle been out of commission for a single day owing to mechanical or electrical defect :—

Depreciation, 10 per cent. on chassis, less battery and tires, *i.e.*, on £780, £78; increase at 5 per cent. on decreasing capital, or 2½ per cent. on £780, £20; electrical energy, 5,958 units at 2d. per unit, £50; tires, 4,392 miles, £17; battery upkeep, £100; insurance, £13; wages, driver and mate, £410; repairs, oil, &c., £97; total, £785. The coal carted amounted to 6,839 tons, and the clinker to 1,263 tons, or a total of 8,102 tons carted at a cost of 1s. 11d. per ton. The mileage reached 4,392 miles. The vehicle has now been in operation for over two years, and has given entire satisfaction.

While the output of electrics was restricted during the war, there was no slackening in the growth of public opinion of their virtues. As the *Electric Vehicle* points out, perhaps the simplest index to this conversion is afforded by the journals of the motor world, which were at first inclined to treat the battery vehicle with indifference, and we are quite in agreement with the statement that it is to the credit both of these journals and of the makers of petrol-motor vehicles themselves that they have come quickly to realise that the two modes of transport are essentially complementary.

In a short article on the advance of the electric in the June issue of the journal referred to above, Mr. C. H. Wordingham, President of the I.E.E., gives it as his opinion that electrical engineers may look forward to a large amount of work in this connection, and that battery makers should find here an outlet for their manufactures to make up for the decline in the use of heavy stationary batteries in central stations.

An interesting account of a severe test made in America not long ago on a four-passenger modern electric, is also given. The owner, who lives in Minneapolis, wishing to learn just what the vehicle was capable of, drove 5 miles out into the country to fetch someone who had agreed to act as observer. The car was then driven back to the city, and caused to mount the steep flight of steps in front of the Court House. The next item was a run of 9 miles to the neighbouring City of St. Paul, accomplished in 24 minutes. The car was then driven up the steps of the State Capitol. After driving about the environs of the city, a run back to Minneapolis was made against a head wind of 38 m.p.h., the distance of 9 miles being covered in 26·5 minutes. Further runs were made along different and indifferent roads until a total of 70·7 miles was recorded. The car was a model 22 Milburn, and carried a battery of 22 17-plate cells of the lead-acid type.

The Institution of Electrical Engineers and Kindred Societies.—The following telegram of congratulation was sent to the Electrical Engineering Institutions of America, Belgium, France, Italy, and Japan, on the occasion of the annual dinner of the Institution, June 26th, 1919 :—"Fraternal greetings to their brother electrical engineers, allies in war and peace, from members of British Institution of Electrical Engineers assembled at first festival since outbreak of war, 1914.—Wordingham, President."

The replies were as follows :—

Brussels, July 2nd, 1919.

Deeply appreciative of your friendly courtesy, the members of the Société Belge des Electriciens join most heartily in the first celebration of their brothers, the British Electrical Engineers, and send them their most cordial greetings.

Piérard, President.

Paris, July 1st, 1919.

Deeply moved by the affectionate thoughtfulness on the part of their fellow-members of the British Institution of Electrical Engineers, the members of the Société Française des Electriciens send them fraternal greetings on the occasion of their first celebration, and rejoice with them over the fact that the Peace treaty has been signed.

Mazan, President.

Milan, July 3rd, 1919.

The Members of the Associazione Elettrotecnica Italiana return to their English colleagues their expression of warm friendship, already traditional, which the present Allied victory has happily sealed.

Ferraris, President.

Tokio, July 9th, 1919.

Your cordial greetings heartily appreciated and reciprocated.

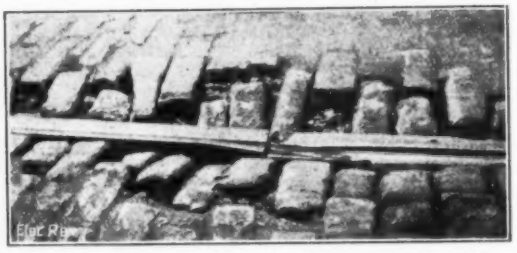
Mamba, President, Denkigakkai.

A "Hot Wire" Microphone.—The possibilities of the hot-wire microphone as an accessory to the telephone were indicated at Monday's sitting of the Royal Commission on Awards to Inventors. The inventor is Major Tucker, and his counsel, Mr. Romer, said that the award of £4,000 was made in March on the undertaking that the patent should be handed back to the inventor. The award had not been paid, said Mr. Romer, and a letter had been received from the Treasury to say that the Government desired to re-assign the patent absolutely to the patentee. Major Tucker desired to have the patent for his own use. Experiments were constantly proceeding, added Mr. Romer, and the invention was one of world-wide importance. Therefore Major Tucker was not anxious to get rid of any of his prospective rights. The Chairman asked if there was any reason at present for the invention being kept secret. Mr. Romer said there was not. It was used by a great many people, and had been captured by the enemy. Mr. Trevor Watson, for the Treasury, said that it was impossible to say at present the probable extent of the use of the patent by Government Departments. The invention was used for sound ranging during the war. Its probable use by the Post Office was mentioned as one of its commercial possibilities. The Chairman suggested that the patent should be assigned to Major Tucker with a licence to the Crown to use it as they thought fit. Major Tucker would thus get the commercial use of it, but the State would get the commercial use so far as the Post Office was concerned. Counsel came to an arrangement on these lines, and the Chairman expressed the hope that the £4,000 would be paid very promptly by the Treasury.

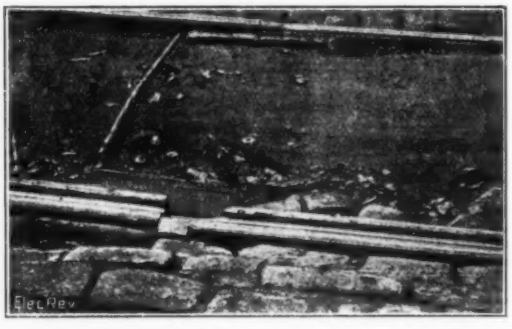
Engineering Congress at Java.—Arrangements have been made for a general Engineering Congress to be held in Batavia, Java, in May, 1920. It will deal, among other things, with railways, tramways, telegraphy, and telephony. The main object is to influence the technical development of Eastern Asia. The proceedings will be conducted in Dutch and English.—*Board of Trade Journal.*

Car Lighting and Starting.—Messrs. C. A. Vandervell and Co., Ltd, have sent us a copy of their "Running Instructions" for the C.A.V. dynamo car lighting and starting system, a neat pocket brochure. The instructions are simple and clear, and the illustrations extremely good; full directions are given for the care of the dynamo, battery, and lighting equipment, the mechanism of the gear-drive starter is fully explained, and numerous hints are given for the localisation of faults, the proper use of the various apparatus, and the materials required for cleaning and lubrication. A complete diagram of connections of the whole of the electrical equipment is provided, and incidentally indicates the increasing importance and versatility of electricity on motor cars.

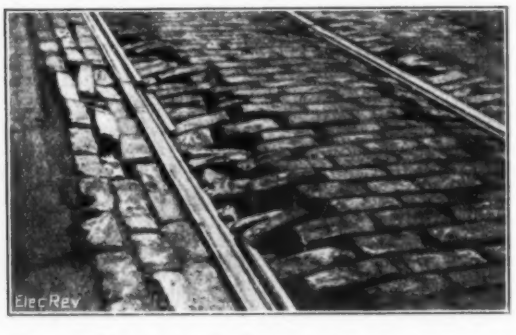
Track Maintenance in Canada.—The accompanying illustrations, reproduced from photographs sent to us by a friend who is travelling in Canada, speak for themselves as to the con-



dition that a tramway track can get into. The photographs were taken within a distance of about 50 yards on Front Street, between the Union Station and George Street, on the track of the Toronto Street Railway Co., where the traffic is very dense. We feel that



it is only fair to ascribe the appearance of the track and pavement, like most other abnormal sights, to the Great War; needless to say, in peace time the track, we feel sure, is maintained in faultless



condition. Let our tramway managers at home study these views, and console themselves with the thought that, after all, someone is worse off for track maintenance than they are.

Why Sir A. Steel-Maitland Resigned.—In the *Times* for July 26th, Sir A. Steel-Maitland describes the difference of opinion on policy between the President of the Board of Trade and himself. He says:—"The difference in principle was this. The Department of Overseas Trade was founded in 1917 as the result of an agreement, under which responsibility for foreign trade was shared between the Foreign Office and the Board of Trade, and it was administered on that understanding. Sir Auckland Geddes, on the other hand, was of opinion that the only possible solution of the problem of dealing with foreign trade was for the President of the Board of Trade to be directly responsible for all trade questions, foreign as well as domestic. I had once been inclined to take the same view, but two years of experience forced me to the conclusion that to attempt to eliminate the Foreign Office from responsibility for foreign trade would be a great mistake. Sir Auckland Geddes insisted on his view (an insistence which has caused regrettable delays). The result was that, as Sir Auckland Geddes himself acknowledged, the position of the man in charge of the Department of Overseas Trade became practically impossible, and I had no other course but to resign."

London Traffic.—On Monday last the report of the Select Committee of the House of Commons on London Transport was published. The principal recommendation is the immediate appointment of a Supreme Traffic Board for Greater London, to consist of not more than five paid commissioners, armed with all the powers possessed by existing authorities, or conferable by statute, and with executive powers; the functions of the Board will be to co-ordinate routes and services of all systems of transport; to regulate all traffic and street repairs, to be responsible for the comfort and convenience of the public, to provide for future developments, and to promote legislation to desired ends. With regard to fares, while some increase was inevitable in view of post-war conditions, the new fares are in cases excessive, in others unjust, and too manipulated to be understood by the public. Greater uniformity is essential, and anomalies must be eliminated. The policies entailing such increases are open to criticism. The Committee describes the existing congestion of traffic as a scandal, and accuses the transport agencies of overcrowding conveyances in order to secure better receipts. It is pointed out that the growth of the amusement habit, the raising of the standard of living, shorter working hours, and the Summer Time Act are amongst the causes of increased traffic, which in 1918 was estimated as follows:—

Local railways (exclusive of suburban traffic on main lines)	699,000,000
Tramways (including outer-urban and "Combine")	992,000,000
Omnibuses (including Tilling's and National Steam 'Bus Co.)	682,000,000
Total	2,373,000,000

or an increase of over 1,000,000,000 in 10 years from 1,363,815,165. In 1913, the last complete pre-war year, the total was 2,007,348,055. The approximate number of journeys per head per year of the civil population in Greater London in 1918 was 101·2 (local railway lines only), 149·5 (tramways), and 102·8 omnibuses.

With regard to the functions of transport, the Committee complains that there was a regrettable absence on the part of all Government Departments, or local authorities or transport agencies, of a broad view of public requirements.

Numerous anomalies and abuses are pointed out, and remedies suggested. The Committee regards the rating of the tramways and their contribution towards the maintenance of the surface of the roads, as compared with the immunity of the omnibuses from both these charges, as indefensible. The policy of the L.C.C. is criticised for want of foresight and progressiveness, and the system of police control is freely condemned.

The King's Speech in the City.—The King and Queen and other members of the Royal Family came to the City on Tuesday to receive an address from the Corporation commemorating the conclusion of Peace. In the course of His Majesty's speech in reply the following sentences occurred:—

"One of the most important tasks before us in the restoration of our overseas trade.

"With the end of the war a great chapter in the history of our country is closed. The new era which is opening before us brings its own tasks, and the same qualities which have carried us to victory will be needed in full measure for the work of reconstruction. The spirit of the union, self-sacrifice, and patience, which our people displayed during the years of fighting will still be required if we are to reap the full benefit of the peace which we have won; and these great qualities must be reinforced by the homelier virtues of industry and thrift.

"As was inevitable in the prosecution of the war, we have been living largely on our capital. Now that we are at peace again, our country urgently demands from every citizen the utmost economy in order to make the best use of the resources which the nation possesses, and strenuous and unremitting industry in order to ensure the greatest possible production of necessary commodities. Without these we shall have to face depression and poverty. Without these we cannot hope to maintain the high position in the industrial and commercial world which we held before the war."

Appointments Vacant.—Fitter-driver for Diesel engine, for the Hebden Bridge U.D.C. Electricity Works; assistant shift engineer (45s. + war bonus), for the Islington B.C. Electricity Department; plumber-jointer (42s. 6d. + 28s. 6d. + 12½ per cent.), for the City of Carlisle Electricity Works; shift engineer (85s.), for the Wakefield Corporation Electricity Department; telegraph inspectors and mechanicians (£250 + £120), for the Nigerian Posts and Telegraphs Department. See our advertisement pages to-day.

The Electricity (Supply) Bill.—On Wednesday, last week, Standing Committee B of the House of Commons continued the consideration of Clause 5. Amendments were adopted permitting railway companies which used electricity for traction to submit schemes to the Commissioners, and ensuring that no scheme should provide for the transfer of other than the generating stations and main transmission lines without the consent of the

owners, but a proposal that the district electricity boards should be elected by the local authorities was rejected. On the following day an amendment providing that representatives of local authorities should constitute a majority of the members of a district electricity board was rejected, and Clause 5 as amended was added to the Bill.

On Tuesday last an amendment to Clause 7 excluding the generating stations belonging to dock companies from the scope of the Bill was carried against the Government, but the latter agreed to exclude railway companies' power stations. The question of the price to be paid for generating stations taken over from local authorities was raised, and it was proposed that the price should be the actual outlay less depreciation; the subject was under consideration when the Committee adjourned.

Chicago Riots.—During the race riots which occurred at Chicago, last week-end, telegraph and telephone wires were cut, and the tramway services were stopped after a number of cars had been destroyed. Considerable casualties are reported. A later message states that the tramway men, numbering 5,000, struck work on Tuesday morning for higher wages.

British Scientific Products Exhibition.—The Glasgow Corporation has arranged for the Exhibition to be held in that city from November 17th to 29th.

Gas on Trains.—The following particulars of a collision near the Firozabad Station recently appeared in the *Pioneer*:—

A collision occurred at 8.40 p.m. between a passenger train from Makhanpur and a down goods train consisting of 50 odd empty trucks. The passenger train was running late and making up time. Its estimated speed was 35 miles, and that of the goods 25 miles, per hour. The trains collided some two miles out of Firozabad, on a straight track; both engines were derailed, and the boiler of the goods engine was completely detached from the body. Five out of six of the engine crews were killed outright. The tender of the passenger train was in a vertical position, and the crew was found buried under the coal. Other portions were telescoped, but the remainder of the train, consisting of four carriages with a brake-van, was not severely damaged. This portion was uncoupled and hauled away by a light engine. The large death roll was due to the rapidity with which the carriages caught fire, owing to the gas cylinder bursting. The fire was fanned by a strong wind which was slowing the down train. The train was a crowded one, and the load was anything from 700 to 950. It was generally accepted that not fewer than 250 persons perished in the burning portion of the train. The number of persons taken out killed or who subsequently succumbed was 15, excluding the engine crews.

Happily, we at home have escaped such disasters during recent years; but as long as gas is used for lighting trains, these terrible holocausts will surely recur.

Oil-Fields of England, Ltd.—A prospectus with the above title has been circulated to investors. The lists opened on July 28th, and were to close on July 30th, thus, like so many affairs of a similar order, avoiding the criticisms of the technical Press. The prospectus makes much of the pressure of the oil, of its quality, and so on. Pressure may mean anything or nothing. Quality, apart from freedom from sulphur, is an unalterable thing, for the hydrocarbons are chemical products, and bound by Dalton's atomic law.

A borehole was made prior to the war to the depth of nearly 2,500 ft.; its cost should not have exceeded £5,000. No less than £85,000 is being asked for this small borehole of 2¼ in. diameter. There are reports dated 1911 and 1914 from the late Sir Boverton Redwood, who in geological work was well known to rely upon Mr. W. H. Dalton and Mr. A. W. Eastlake, but when we look for their reports we find them absent from the prospectus; Sir Boverton has merely referred to them, and in such a way that we find it difficult to believe that anything really serious was said in favour of a plentiful yield of oil by either of the experts. The further report of Mr. Ford seems to us very unconvincing. We hope there is oil, and oil in plenty, for it would save England from having to buy oil outside the kingdom. The further exploitation of this Newark area ought to be the work of speculators, or rich men imbued with such ideas, but it should not be foisted on the investor, for it is far too speculative a proposition.

Indeed, judging by the small qualification of £100 for a director, and the promoters' willingness to take £80,000 of the purchase money in shares, it would appear that the promoters are trying to get back the cost of the borehole and a lot of shares if some other body will pay £170,000 to find the money to make further borings. Have not the reports as to the oil said to have been found near Chesterfield had much to do with the launching of this prospectus? Was the moment opportune?

This borehole, now nearly 10 years dormant, is surely not sufficient to justify a capitalisation of £250,000, of which £170,000 is now asked from the public.

Is it not a fact that the strata of this island are much too steeply inclined and freely exposed at the surface to justify much hope of extensive oil deposits remaining? There are, doubtless, pockets left, but not great saturated volumes of sand. A well-known geologist is, we believe, on record as having said that oil-boring in England was "wild cat" boring with small hopes of success.

Educational.—The Sheffield Press states that the Bradford Technical College is in course of reorganisation. The Department of Engineering is to be divided into two sections—mechanical and civil engineering, and electrical engineering. Similarly, the present Department of Chemistry and Dyeing is to be made into two departments.

Manchester Municipal College of Technology.—The 1919-20 session opens on October 5th; matriculation and entrance examinations in July and September. For particulars see our advertisement pages to-day.

The Federation of Technical and Scientific Associations.—The Electrical Power Engineers' Association has joined hands with the National Association of Industrial Chemists, the National Union of Scientific Workers, and the Electricity Supply Commercial Association in forming a new Federation with the above title, which is intended to embrace all professional associations of the same type which are registered as Trade Unions. The immediate purpose of the movement is to secure the representation of such Trade Unions upon Industrial Councils, and other bodies of a similar nature, in order that the interests of the managing class, which stands between the employers and the workmen, may be adequately safeguarded: at present no such provision is made, and it is felt that collective action is indispensable, in order to press the claims of this important class—the brains of the industries. Other questions of common interest will doubtless claim the attention of the Federation from time to time. The new body, which is in no sense hostile to the manual workers' unions—indeed, in many respects their needs are identical—will invite kindred associations to join it, in order that the maximum influence may be exerted by joint action.

Fuel Economy.—As mentioned in our issue of July 11th, in the Household Fuel and Lighting Order, 1919, there is a clause (No. 56) restricting the installation of new appliances on the lines of Clause 99 of the Order of 1918. We now learn from Mr. J. W. Beauchamp, director of the Electrical Development Association, that he has received a letter from the Coal Control Department, dated July 24th, which reads as follows:—

"I am obliged for your letter of July 15th, enclosing copies of your notes on Clause 56 of the new Order. After careful consideration, it has been decided to relax the restriction to the following extent:—

> "Where the Local Fuel Overseer is satisfied that the gas or electricity undertaking in his district is in a position to meet any increased demand which might arise, he may give a *general assent* permitting the undertaking to make new connections, and to fit additional appliances. The assent should be withdrawn if at any time the undertakings experience difficulty in meeting the demands. It is suggested that Local Fuel Overseers and managers of electricity and gas companies should work in conjunction in this matter.

"As regards the case of London, the question of exemption will be dealt with by the divisional officer for the metropolitan area, and not by the Local Fuel Overseers."

Under the circumstances, and in view of the difficult position existing to-day with regard to coal, Mr. Beauchamp thinks that perhaps the above concession is as much as we could expect, and should in practice work quite well, as the electricity supply undertaking will presumably do all they can to make possible increase in connections, and apparently it will lie with the electricity supply managers to satisfy the Local Fuel Overseer that they are not likely to get into any difficulties. Our congratulations are due to E.D.A. on the success of her efforts.

Heat Balance of Muscle Shoals Nitrate Plant.—The method of operating this power installation is described in *Power*, May 27th, it being shown how the heat balance is maintained. The hotwell water varies between 68° and 100° F., corresponding to the highest and lowest vacua, with an average of 80° F. This is used to cool the oil supply of the 60,000-KW. unit, which requires 200,000 lb. per hour. This is heated to 130° F., and a considerable heat saving is obtained by this cooling arrangement. A booster pump forces the water through the oil coolers, but its power consumption only amounts to 1 per cent. of the heat saved. All auxiliary apparatus is electrically driven, except the boiler feed pumps. The thermal efficiency of the plant is increased by raising the surplus exhaust point and obtaining all possible power from the house turbines. This is obtained by increasing the back pressure. The steam consumption of the house turbines increases rapidly with the back pressure and because the exhaust-heat content becomes greater. Thus a point is reached where the power obtained from the house turbines begins to decrease as the back pressure is increased, which point is in all cases considerably in excess of 5 lb. The saving between 2·5 lb. and 5 lb. back pressure amounts to 1 per cent. at a station-load of 50,000 KW. A number of interesting graphical heat-balance studies taken from this plant are included in the original article.

Seaplane Wireless Sets.—The wireless set on the N.C. seaplanes comprises two transmitters. The first is a ½-KW. spark set supplied by a streamline generator driven by an airscrew. The set weighs 45 lb., and can be used for a distance of 250 nautical miles. The antenna consists of a single trailing wire 250 ft. long, hanging from the tail of the machine and weighted by a streamline lead weight. The second set is a combined telegraph and telephone transmitter working on a small 12-volt accumulator. It is used on an antenna consisting of wires permanently stretched on the skid fins on the upper planes, so that it may be used while the seaplane is in flight or on the water. This set is chiefly used for telephonic intercommunication between aeroplanes in flight, the effective range in this case being 20 miles. When used for telegraphing or telephoning from a seaplane on the water, the range is about 30 miles. A special feature of the telephone sets is the anti-noise microphone. The set is fitted with a direction indicator to enable the bearing of a station transmitting a message to be determined. The complete equipment weighs 200 lb.—*Aircraft Journal.*

The British Association.—Many interesting subjects in connection with scientific work during the war will come up for discussion at the coming meeting of the Association at Bournemouth, from September 9th to 13th, under the presidency of the Hon. Chas. Parsons. Wireless telegraphy during the first three years of the war will be discussed by the mathematical and physical section.

Thunderstorms.—The annual report of the director of the solar physics observatory at the University of Cambridge contains interesting results on lightning discharges and on the electric field of thunderstorms. The observations, which were made chiefly in the summer of 1917, were made possible by improvements in the methods of measurement, including the provision of an apparatus for giving a photographic trace of the electrometer readings. It was found possible to record changes in the potential gradient occupying less than one-tenth of a second. The distance between the place of observation and the lightning discharge was estimated from the time interval between the lightning and thunder. On that basis it was found that the average change produced in the potential gradient by lightning discharge within one or two kilometres was of the order of 20,000 volts per metre, and for discharges at a distance of 10 km. of the order of 1,000 volts per metre. The charge which feeds a lightning discharge appears to be derived, not from an extended horizontal sheet, but from a limited area approximately of the same depth and width, which, therefore, for theoretical purposes, may be regarded as a sphere. It was estimated that the radius of these spheres was of the order of 300 or 400 metres and the maximum potential before discharge approached 1,000 million volts. The power dissipated in a severe thunderstorm in a single discharge might reach 1,000 KW. The results obtained have suggested a theory which correlates the more important phenomena of thunderstorms with the electrical conditions of fine weather and with terrestrial magnetism. Thunder and other clouds from which heavy rain is falling are regarded as electrical generators by which electric currents are maintained between the earth and the conducting layer of the upper atmosphere. Currents in the upward direction preponderate, because the carriers of negative electricity have a greater mobility. The positive potential of the upper conducting layer is thus maintained, and the downward current in regions of fine weather supplied. The electric force produced in the upper atmosphere above a thunderstorm at the moment of passage of a lightning discharge appears to be great enough, not merely to produce ionisation, but also to give rise to cathode rays, positive rays, and X-rays. This theory points to the possibility that the source of origin of the emission of radiations from the sun may be the result of processes similar to those existing in terrestrial thunderstorms.—*The Times.*

Technical Training.—The Appointments Department of the Ministry of Labour has in preparation a series of kinematograph films showing students in course of training for various trades and industries, which will be shown at kinema theatres throughout the country. Applications for training have been received from 18,000 ex-officers and men for instruction, but only 2,000 have been provided for, and openings are available at present for only 1,300 of the remainder. Employers are urged to forgo premiums and assist in placing the men.

International Standardisation.—As the result of the recent visit of Prof. Comfort A. Adams, of Harvard University, President of the American Institute of Electrical Engineers, and Mr. H. M. Hobart, of the General Electric Co., Schenectady, to England and France, with a view to adjusting certain differences between the French and American standards for the rating of electrical machinery, agreement has been reached, and certain amendments to the rules of the International Electrotechnical Commission will be recommended at the next meeting of the Commission, which is expected to be held in London in October this year. Prof. Adams and Mr. Hobart were also commissioned to establish relations between the American Engineering Standards Committee and kindred organisations in Europe.

Patents and Trade Marks.—The Patents Bill was read a second time on Monday, and will apparently enable patent rights to be granted for the sum of £5. Sir A. Geddes, for the Government, said that broadly the principle of the Bill was to improve the position of the inventor and make it easier for an inventor without capital to reap the fruits of his invention. It would also prevent abuse of British patent laws by foreign inventors, extend the duration of protection from 14 to 16 years, and raise the calling of patent agents to a profession. Clause 2 of the Bill instituted a new form of patent; if the patent was endorsed "licence of right," a licence to manufacture or work it could be negotiated as a matter of right, but at the same time the inventors' royalty rights would be safeguarded in every way.

An appeal that the Bill should be strengthened to deal with "trusts" was made by Mr. Graham, and in reply the Solicitor-General said it was intended to introduce an Anti-Trust Bill in the autumn.

The Trades Marks Bill was also read a second time. Sir A. Geddes explained that under the first part of the Bill it was intended to have a register of trade marks which had common-law existence, and in the second part to have a register into which it would be easier to get trade marks than into the first. The second part of the Bill had very considerable practical importance. As an example, in the case of certain drugs, where the name of the drug was the trade mark, they got a permanent continuation of the patent protection, and much difficulty had been experienced in this respect. The Bill would make a great improvement in the Government's present powers relating to the use and protection of trade marks.

Merchant Shipping (Wireless) Bill.—The Standing Committee presided over by Mr. T. P. O'Connor dealt, on the 25th inst., with the Merchant Shipping (Wireless) Bill. An amendment that ships should be allowed to use their installations in port, in view of the difficulty in the present circumstances of conducting business by means of private telegrams, was withdrawn. Mr. Bridgman said he could not say when the Admiralty was likely to permit the use of wireless in ports, but the B. of T. was anxious to remove the restrictions at the earliest possible date. An amendment to omit the word "seagoing," so that the Bill would apply to all passenger vessels, was defeated. Mr. Bridgeman mentioned that pleasure steamers at Llandudno would come under the operation of the Bill. It was mentioned that during the war the number of British ships fitted with wireless rose from 1,000 to 2,700. It was agreed that the Bill should become operative three months after its passing into law.

Germans Disgorging.—According to the daily Press the Belgian Service of Restitution at Wiesbaden reports to the Supreme Council of the Allies that the work of getting back stolen machinery and material from the Germans is now proceeding smoothly. Quantities of about 3,000 tons a week are being returned to the original owners by Germans who had set them up in their own factories. During the past fortnight an average of 125 machines a day has been returned, the total tonnage up to the present being 18,000. The recovery of raw material is proving a less easy matter. The Belgians from whom it was taken experience some difficulty in preparing complete lists, but the return of raw material is part of Germany's indemnity to Belgium.

International Congress of Inventors and Designers.—The *Patent Office Journal* states that an International (Allied and Neutral Countries) Congress of Associations of Inventors and Industrial Designers and of other Societies connected with Industrial Property will be held at Brussels from September 2nd to 6th, 1919. Particulars of the conditions of membership of the Congress, and of the programme of proceedings, are given in a pamphlet which may be inspected in the Public Library of the Patent Office. Copies of this pamphlet can be obtained from the Secretariat-Général du Congrès, Palais de la Bourse de Commerce, Brussels. The notice is issued by the Industrial Property Department of the Board of Trade.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.

Central Station and Tramway Officials.—The deputy manager at the Leatherhead Electricity Works, Mr. F. H. SMITH, of Messrs. Banks Warner, Ltd., who has been in charge since January, 1917, has vacated this position on the return of Captain H. Leslie Dixon, who has been released by the Royal Air Force.

The Highways Committee of the L.C.C. recommends as from August 1st next the following promotions and transfers in the Council's tramways department (salaries based on pre-war conditions—that is, plus allowances, &c.):—

Mr. T. L. HORN, distribution engineer, northern section, to be appointed distribution engineer of the electrical branch of the tramways department at £625, rising to £700 per annum.

Mr. N. H. THOMAS and Mr. R. S. GOOD, sub-station superintendents, to be assistant distribution engineers for the southern and northern sections respectively at £350 per annum, rising to £400.

Mr. E. A. GLOVER and Mr. A. J. ROBERTS, mains inspectors, to be promoted to mains superintendents for the southern and northern sections respectively at £250 per annum, rising to £300.

Mr. A. W. LEACH, second-class assistant in the rolling stock branch, and Mr. F. COOK, technical assistant, to be appointed technical assistants in the rolling stock branch at £250 per annum.

Mr. S. B. SCOTT to be appointed rolling stock inspector at £230 per annum.

Mr. J. R. WIGNAL to be appointed senior technical assistant in the permanent way branch at £450 per annum, rising to £600.

Mr. G. P. HENZELL, assistant power engineer, L. & S.W. Rly. Co., Wimbledon Station, has been appointed repairs superintendent at Greenwich power station at £300 per annum, rising to £400, plus war allowances of 20 per cent. and £90.

On July 29th, at Pontypridd, Mr. E. W. JONES, engineer and general manager of the Mountain Ash U.D.C. electricity department, was married to Miss L. J. Evan, daughter of Mr. and Mrs. Evan Evans, Ynysbwl.

It is recommended that the salary of Mr. CHAS. FURNESS, the borough electrical engineer and tramways manager at Blackpool, shall be increased as from April last from £900 per year to £1,250.

In regard to the salaries of the higher officials of the Barrow Corporation, including that of the borough electrical engineer, Mr. H. R. BURNETT, the Town Council on Monday decided "That the scale of war bonuses authorised by the award No. 84 of the Conciliation and Arbitration Board for Government Employés, dated March 31st, 1919, viz.: 20 per cent. of their ordinary remuneration, plus £60 a year, be adopted as

regards the officers of the Corporation, other than those dealt with by the Council on April 7th, the present war bonus to be merged in such scale, and the scale to take effect as from April 1st last." This is in accordance with the recommendations of the Association of Municipal Corporations.

Mr. F. French, deputy borough electrical engineer, Bridlington, upon his leaving Bridlington to take up the position of resident engineer to the Horsham U.D.C., was presented by his brother officials with a silver rose bowl. The staff at the electricity works also presented him with a case of silver tea knives.

Mr. W. D. Fisher has resigned his post as assistant mains superintendent to the Barrow Corporation, which post he has held for eight years, to take up a position as assistant distribution engineer for the Bury Corporation.

Dundalk Urban Council has increased the salary of Mr. Spalding, electrical engineer and manager, from £400 to £500.

At a meeting of the Bradford Corporation Electricity Committee on July 23rd, Mr. Johnstone Wright was appointed out of 139 applicants to the position of chief assistant electrical engineer at £750 per annum. Mr. Wright is at present chief engineer and superintendent of power stations with the Cleveland & Durham Electric Power, Ltd., with which company he has served in various capacities for close upon 13 years. Mr. Joseph Smith, chief accountancy clerk in the West Ham Corporation Electricity Department, was selected to fill the post of managerial assistant at £500 per annum. For this appointment there were 247 applicants. Mr. Smith has occupied his present position for 13 years, and was previously employed for 4½ years as assistant accountant with the Barking Town Urban District Council and for 6½ years in the borough treasurer's department, Nelson.

Melbourne City Council has voted £250 for the purposes of a presentation to Mr. H. R. Harper, the retiring city electrical engineer.

On July 23rd Mr. C. E. Acock, repairs engineer, was presented with a leather suit case by the staff and employés on the occasion of his leaving to take up another appointment. Mr. H. F. J. Thompson, the chief assistant engineer, made the presentation in the presence of the staff and employés.

General.—The directors of the Clyde Valley Electrical Power Co. have appointed Mr. Archibald Page general manager of the company in place of the late Mr. D. A. Starr.

Mr. Arthur R. Wood has been appointed manager of the electrical department of the Falkirk Iron Co., Ltd., and will shortly take up his duties there. Mr. Wood, who has had 20 years' experience in the manufacture and design of electrical cooking and heating appliances, was with the General Electric Co., Ltd., for 12½ years, and latterly with Carron Co. and the Jackson Electric Stove Co., Ltd., of London, as manager.

Mr. James E. Naismith has vacated his position of district engineer, construction department, at the Birmingham office of the Western Electric Co., Ltd., having been appointed Scottish representative for the company, with headquarters at 49, West Campbell Street, Glasgow. For many years Mr. Naismith was in the electrical department of the Glasgow Tramways, and he hopes to renew old friendships in that city.

It is stated in the *Times* that Mr. Arthur Gulston has resigned the position of chief engineer to Messrs. Armstrong, Whitworth & Co., Newcastle, after 36 years' service.

Lieut. (Acting Lieut.-Comdr.) H. de C. Falle, R.N.V.R., has received the honour of the Order of the British Empire in recognition of his electrical services in the Grand Fleet during the war.

Capt. R. Sharp, Tyne Electrical Engineers (Territorial Force), has vacated the adjutancy of the corps, which he joined shortly after the outbreak of the war. He was promoted captain in June, 1916, and held the adjutancy for the past six months.

Lieut. R. H. Sperling, London Electrical Engineers (Territorial Force), has been restored to the establishment. He was commissioned in the regiment in 1916, and was latterly serving under the Ministry of Munitions, during which time he was a supernumerary officer.

Mr. W. H. N. James, A.R.C.Sc., is recommended by the Technical College Committee of the Bradford Corporation for appointment as head of the department of electrical engineering of the college at £500 per annum and bonus from September 1st, 1919. This is a new appointment, the electrical department being specifically separated from the general engineering department of the college under a reconstruction scheme.

Mr. L. E. Wood, A.M.I.E.E., who for the past seven years has held the position of chief electrician to the Montreal Cottons, Ltd., has resigned that position, and will arrive in England in the early part of August.

Lieut. and Acting Captain W. M. Herring, Essex Fortress R.E. (Electric Lights Companies), has relinquished his acting rank on ceasing to be employed. He was appointed to the corps in December, 1914, as a subaltern of No. 2 Company at Chelmsford.

Mr. Anthony Hodgson, who is at present home at Burnley on leave, has received the decoration of M.B.E. for services rendered in the war. He was appointed chief superintendent to the Eastern Telegraph Co. at their Gibraltar Station in 1914, and he rendered valuable service on the cables during the war.

Lieut. S. Howard Hall, R.N.V.R., has been awarded the O.B.E. (Military Division) "for valuable services as electrical lieutenant in H.M.S. *Revenge*, 1st Battle Squadron."

Mr. John W. Mayall, Lieut. R.A.F., who has recently been demobilised, has now resumed his active connection with Messrs. Mayall & Co., Ltd.

The Board of Trade announce that Sir Evan Jones, Bart., M.P., has resigned his position as chairman of the Road Transport Board.

Major P. A. Smith, R.M., who has been awarded the O.B.E. (Military Division), "for valuable services in connection with defensive mining," carried out a good deal of submarine mining work around the Orkneys during the war. He was stationed there for 3½ years, and last year relaid all the observation minefields with a new and successful device. He is now on the staff of the Rear-Admiral Controlled Minefields, and is employed in supervising the installation of electrical gear which is being erected in the various structures which come under control of this department of the Admiralty.

Obituary.—Mr. J. D. Wardale.—The death occurred recently of Mr. J. D. Wardale, head of the firm of Carrick & Wardale, electric crane makers and engineers, of Gateshead.

Mr. J. Connolly.—We regret to learn that Mr. James Connolly, retired electrical engineer, of Rochdale Road, Blackley, near Manchester, lost his life by drowning on July 24, at Windermere, whilst boating. He was 53 years of age. According to a report of the inquest in one of the Manchester newspapers it appears that on account of overstrain, Mr. Connolly had gone to Windermere for a holiday with his son, Lieut. H. Connolly, of the Irish Guards. Lieut. Connolly stated that his father had been quite cheerful and bright since his arrival, and went out each morning for a row. He had business worry, but not sufficient to make him take his life. A boatman said he saw Mr. Connolly in the water as if swimming, and found him upright in the water close to the rowing boat. Dr. Henderson was of opinion that death was not due to drowning. Mr. Connolly might have had a sudden heart or epileptic seizure, and fallen into the water, the shock causing a temporary revival which would account for his position in the water when found. The Coroner returned a verdict that Mr. Connolly was found dead in the lake after a fall from a boat, but that the evidence was insufficient to show the cause of death.

Mr. J. Wright.—The death occurred last Saturday of Mr. J. Wright, foreman electrician for the L. & Y. Railway Co., at Fleetwood, following an accident while at work on the company's Belfast steamer.

NEW COMPANIES REGISTERED.

Atlas Mining Outfit Co., Ltd. (157,110).—Private company. Registered July 16th. Capital, £10,000 in £1 shares. Objects: To take over the business of manufacturers of and dealers in pit props, underground conveyors, and mine appliances carried on by E. Mills, Annie Mills, W. A. Machin, and Martha A. Machin, as the Atlas Mining Outfit Co.; also to carry on the business of manufacturers of and dealers in electric lamps and apparatus, tools, &c. The subscribers (each with one share) are:—E. Mills, Kirkleatham, Lansdowne Crescent, Great Malvern, Worcs., manufacturer; Mrs. A. Mills, Kirkleatham, Lansdowne Crescent, Great Malvern, Worcestershire; W. A. Machin, Whitby House, Rolason Road, Erdington, Birmingham, mechanical engineer; Mrs. M. A. Machin, Whitby House, Rollason Road, Erdington, Birmingham; G. P. Locker, 67, Colmore Row, Birmingham, solicitor. The first directors are E. Mills (chairman), Mrs. A. Mills, W. A. Machin, and Mrs. M. A. Machin. Secretary: E. Mills. Solicitor: G. P. Locker, 67, Colmore Row, Birmingham. Registered office: County Chambers, Corporation Street, Birmingham.

Veitch Institute of Electro-therapeutics, Ltd. (157,291).—Private company. Registered July 22nd. Capital, £1,000 in £1 shares. Objects as indicated by the title. The subscribers (each with 10 shares) are: Dorothy Veitch, 43, Manchester Street, W.1, specialist in electro-therapeutics; W. G. Brown, 16, St. George's Square, Primrose Hill, N.W., accountant. Directors: Dorothy Veitch and W. G. Brown. Qualification, £5. Secretary: W. G. Brown. Registered office: 43, Manchester Street, W.1.

J. Hadden & Co., Ltd. (157,335).—Private company. Registered July 24th. Capital, £10,000 in £1 shares. To carry on the business of manufacturers and repairers of, and dealers in, electric light fittings, and electric, magnetic, galvanic, and other apparatus, &c. The permanent directors are:—J. Hadden, Lawnswood, Clairview Road, Streatham Park, S.W.; H. Barker, 7, Neeld Crescent, Wembley Hill, Middlesex. Qualification, £500 shares. Remuneration, £50 each per annum. Solicitors: Humber, Bull & Co., 6, Old Jewry, E.C. Registered office: Haydn Park Works, Askew Road, Shepherds Bush, W.12.

Macquaire, Ltd. (157,338).—Private company. Registered July 24th. Capital, £10,000 in £1 shares. To acquire certain inventions relating to sparking plugs, to carry on the business of manufacturers of, and dealers in, sparking plugs, magnetos, ignition appliances, motors, boats, launches, aircraft, and their parts and accessories, and to adopt an agreement with La Compagnie Industrielle et Commerciale du Cycle et de l'Automobile and L. Macquaire. The subscribers (each with one share) are:—R. Budgen, 96, Mildenhall Road, Clapton, E.5; N. G. Hancock, 64, Mildmay Road, Romford, Essex, clerk. Solicitors: J. B. & F. Purchase, 14, Regent Street, S.W.

W. S. Jeal & Ebury Engineering Co., Ltd. (157,202).—Private company. Registered July 18th. Capital, £20,000 in £1 shares. To acquire the business of manufacturers of and dealers in electrical accumulators and motor-car equipment carried on at Union Wharf, Redhill Street, London, by W. S. Jeal & Co., and to enter into an agreement with (1) W. S. Jeal & Co., Ltd., (2) Vinot Cars, Ltd., H. Ramoisy, G. Usmar, H. Jones and W. S. Jeal; (3) Vinot Cars, Ltd.; (4) with N. A. Usmar; and (5) with H. Jones. The subscribers (each with one share) are: W. S. Jeal, 53, Thurlestone Road, S.E.27, electrical engineer; G. Usmar, 7, Old Court Mansions, W.8, engineer; H. Jones, 6, Town Hall Parade, Brixton Hill, S.W.2, electrical engineer. The first directors are W. S. Jeal, G. Usmar, H. Jones and H. Ramoisy (Belgium), 11, Kensington Mansions, Earl's Court, S.W.5. Solicitors: Plesse & Sons, 15, Old Jewry Chambers, E.C.

Hamer & Co., Ltd. (157,177).—Private company. Registered July 19th. Capital, £5,000 in £1 shares. Objects: To carry on the business of electricians, mechanical and motor engineers, suppliers of electricity for the purposes of light, heat, motive power or otherwise, &c. The subscribers (each with one share) are: W. Hamer, 25, Hill Crest, Burnley Road, Sowerby Bridge, electrician; J. Fletcher, 37, Howard Street, Pellow

Lane, Halifax, electrician. The first directors are W. Hamer and J. Fletcher. Solicitor: E. Booth, 7, Harrison Road, Halifax. Registered office: Carlton Electrical Works, Bull Close Lane, Halifax.

Herrtage, Lester & Co., Ltd. (157,233).—Private company. Registered July 21st. Capital, £2,000 in £1 shares. Objects: To carry on the business of electricians, electrical engineers and manufacturers, suppliers of electricity, carriers, manufacturers of and dealers in railway, tramway, electric and other apparatus, &c., and to adopt an agreement with E. J. Walker for the purchase of certain assets. The subscribers (each with one share) are: C. W. Edwards, 30, Gladstone Park Gardens, N.W.2, solicitor's clerk; G. W. Lester, 71, Carleton Road, N.16, electrical engineer. The first directors are G. W. Lester (managing director), E. J. Walker (South Bank, Ravensbourne Road, Bromley, Kent), and C. W. Edwards. Solicitors: Rundle & Hobrow, 9, Ironmonger Lane, E.C. Registered office: 10, Bush Lane, E.C.

Davies, Coleman & Co., Ltd. (157,270).—Private company. Registered July 22nd. Capital, £7,500 in 5,000 "A" shares of £1 each and 5,000 "B" shares of 10s. each. To carry on the business of manufacturers of and dealers in optical, ophthalmic, nautical, meteorological, mathematical, philosophical, aeronautical, surveying, photographic, surgical, dental, medical, electrical and scientific instruments, apparatus and appliances, ophthalmic lenses, spectacles, eye-glasses and frames, sight-testing instruments, manufacturers of and dealers in gold and silver and articles made therefrom, jewels and precious stones, &c. The subscribers are: G. H. Davies, Hampden Club, King's Cross N.W.1, scientific instrument manufacturer, 2,500 "B" shares; R. Fader, 41, Deodar Road, Putney, S.W., scientific instrument manufacturer, 2,500 "B" shares; P. G. Coleman, 14, Courtfield Gardens, Earl's Court, S.W., scientific instrument manufacturer, 5,000 "A" shares. The first directors are G. H. Davies, R. Fader and P. G. Coleman (all permanent). Qualification, £25. Remuneration as fixed by the company. Secretary: P. G. Coleman. Solicitors: J. N. Mason & Co., 32, Gresham Street, E.C. Registered office: 40 and 42, Holborn Viaduct, E.C.

Service Electrical Co. (Llanelly), Ltd. (157,248).—Private company. Registered July 21st. Capital, £5,000 in £1 shares. To carry on the business of manufacturers of and dealers in electrical generators, motors, transformers, switch gear and the like, electric light and other electrical apparatus, conduits, dynamo machines, &c. The subscribers (each with one share) are: L. Satchwell, 70, Ardwyn Garden Suburbs, Barry Port, electrical engineer; D. H. John, Pleasant Hill, Cross Hands, electrical engineer; J. Jones, Old Road, Llanelly, metal broker. Directors: L. Satchwell (managing director), D. H. John and J. Jones. Qualification, £200. Solicitor: D. Jennings, Cowell Street, Llanelly. Registered office; New Dock, Llanelly.

Warminster Electric Supply Co., Ltd. (157,166).—Private company. Registered July 17th. Capital, £4,000 in 300 cum. preference shares of £5 each and 2,500 ordinary shares of £1 each. Objects as indicated by the title. The subscribers (each with one share) are: A. A. Douglas, "Penyglyn," Flint, North Wales, mercerise; J. H. Edwards, "Haresfield," Stonehouse, Glos., electrical engineer. Directors: A. A. Douglas and J. H. Edwards. Solicitor: S. Williams, Shannon Court, Corn Street, Bristol. Registered office: Cairncross, Stroud, Glos.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Inventions and Research, Ltd.—Debenture for £2,000 registered July 4th, 1919, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: J. R. Remer, Cunard Buildings, Liverpool.

Hooper's Telegraph & India-Rubber Works, Ltd. (40,947).—Capital, £50,000 in 1,000 preference and 4,000 ordinary shares of £10 each. Return dated June 24th, 1919. All shares taken up. £40,000 paid on 4,000 ordinary. £10,000 considered as paid on 1,000 preference. Mortgages and charges, nil.

British Electric Transformer Co., Ltd. (76,351).—Capital, £325,000 in 162,500 preference and 162,500 ordinary shares of £1 each. Return dated June 5th, 1919. 162,075 preference and 161,923 ordinary shares taken up. *£182,219 paid on 152,851 preference and 85,968 ordinary. £85,179 considered as paid on the remainder. Mortgages and charges, nil.

*This is as in filed document, but probably the amount should be £238,819, as balance sheet states that all shares are fully paid.

CITY NOTES.

Suffolk Electricity Supply Co., Ltd.

At Stowmarket last week, Mr. P. C. N. Peddar presided at the annual meeting of this company. The report showed a profit of £2,362 for the year, out of which a dividend of 8 per cent., less tax, was to be paid on the ordinary shares and a dividend of 80 per cent., less tax, on the founders' shares, £865 being put to depreciation reserve. £207 was to be devoted to the purchase of workmen's shares and the balance carried to the general dividend reserve fund, increasing it to £1,170.

The report stated that further reserve power was required immediately at Stowmarket, and the directors had decided to interconnect Stowmarket and Ipswich by means of an overhead main, so obtaining means for interconnecting the company's generating plant at Stowmarket with that of the Ipswich Corporation and thus securing more efficient utilisation of the power available, this again being an expenditure of capital in conformity with the Government scheme. The directors hoped to issue further capital and employ an increased staff still further to develop the company's business, and they invited the shareholders to increase their holdings. To secure the interest of the company's employés in the financial success of the concern, to enable them to realise that they are working not only to benefit the ordinary shareholder, to provide workmen with an opportunity for expressing, officially, their views as to the best means of achieving the objects of the company, to create a community of interest with the shareholders, and generally to secure a basis for carrying out the recommendations of the Whitley Committee, the directors had considered it advisable to issue special shares, to be known as "workmen's shares," and having placed the matter before the leading employés, recommended that the scheme be passed by the shareholders. To inaugurate this scheme, and to mark the directors' appreciation of the employés' devotion to duty during the war and the subsequent satisfactory issue of peace, the directors propose to give, as a bonus, a £1 workmen's share to each employé for every complete year's service in the employ of the company, absence on naval, military, or R.A.F. service not being deducted, and have provided for the purchase of these shares out of the profits of the last year's working.

In the course of his speech on the company's affairs the chairman expressed great appreciation of the untiring attention and energy displayed by the engineer, Mr. Napier Prentice, during over 23 years, against great opposition and difficulty, whereby the company had now been able to reach its present satisfactory position. The chairman was presented with a pair of silver dessert dishes and a silver vase by the directors, staff and employés, as a memento of his completion of 21 years in that position. Later the chairman, in explaining the 80 per cent. dividend on the founders' shares, said that there had been no dividend paid on those shares since the formation of the company. Mr. Napier Prentice informed the meeting that the supply was now on at Beccles and Needham Market, and other towns were urging the company to get to work. All that was necessary was the provision of further capital.

South Wales Electrical Power Distribution Co.

At the annual meeting held at Cardiff last week Mr. W. Gascoyne Dalziel, in moving the adoption of the report, said the results of the year's working showed that after payment of all expenses there was a credit balance of £26,146, which enabled them to pay the interest on the debenture stocks and prior lien debentures, place £8,070 to depreciation and new plant, and to carry forward £52. It was disappointing to have to record that although there was a material increase in the number of consumers and the horse-power connected to the mains during the year, there was a decrease of £365,146 in the number of units sold as compared with the previous year. This was accounted for by the fact that a large proportion of the output was supplied to colliery undertakings, whose business during the period in question was carried on under the most difficult conditions—shortage of labour, strikes, shortage of tonnage, and many other adverse factors tending to cause irregular working of the collieries and restriction of output. From the point of view of development, the position was more satisfactory. During the year 1,539 additional horse-power had been connected to the mains, bringing up the total to 42,662. Since the last annual meeting contracts for supply had been entered into with several new consumers. The new main which was being erected to serve the latter would form an important main feeder and would open up the western portion of the company's area which they had hitherto been unable to supply. The new contracts also included one with the Pontypridd U.D.C., with whom arrangements had been completed for the supply of electricity in bulk. Included in the business arranged for, but which had not hitherto been proceeded with on account of the war and other reasons, were supplies to the Waterloo Tinplate Works, the Tory-Coed Colliery, and Messrs. Hall, Lewis & Co.'s wagon works at Maindy. It was gratifying to find, after so many years of uphill work, that they were now being recognised as an undertaking of public utility, to which power consumers were looking for their requirements to an ever-increasing extent. At the same time they would be wise not to form too sanguine expectations in view of the general unrest, the troubles and difficulties with which they were surrounded, and the uncertainty as to what the future might have in store for them in common with the whole of the industries of the country. The question of the nationalisation of coal mines and the threatened increase in the price of coal, for instance, vitally affected their interests. They were large consumers of coal, and they naturally expected that this consumption would go on increasing. Apart from their interests as consumers they were interested as suppliers, and anything which tended to bring about a reduction of output at the collieries was bound to affect them, as it would undoubtedly still further reduce the output of the pits, and naturally reduce the output of current required from this company. Another matter which added to the uncertainties of the future was the Electricity (Supply) Bill.

Marconi's Wireless Telegraph Co., Ltd.—The net profit for the year ended December, 1918, was £597,938. Adding the balance brought forward there stands to the credit of profit and loss account £974,699. Dividend on preference shares 7 per cent. paid February 1st, 1919, absorbed £17,500; interim dividend on ordinary shares of 5 per cent. paid at same date £61,182. The directors recommend further dividends as follows:—Ordinary shares 20 per cent. for the year (making 25 per cent. for the year), £244,730; preference shares 15 per cent. for the year (making 22 per cent. for the year), £37,500; leaving a balance of £613,787, of which it is proposed to transfer to general reserve £150,000, carrying forward £463,787. The general reserve will then stand at £1,250,000. The report, which bears date July 24th, says:—"There having been no settlement with any of the Government Departments in respect of any of the company's claims arising out of the war or for services rendered during the war, no sum in respect of any of these claims figures in the year's accounts." Following the usual custom, the shares in associated companies and patents are taken into account in the balance sheet at their cost price, viz., £1,365,109. The par value of the shares now stands at £2,345,966, exclusive of shares which have no capital denomination.

Cordoba Light Power & Traction Co.—For the 18 months ended March the balance of profit is £20,160, plus £8,630 brought forward. The issue of £500,000 six per cent. promissory notes of the company matured in December last, and the company exercised its option to renew these notes for two years, and for the greater part the rate of interest was increased to 6 per cent., tax free. In view of the uncertainties

of the present situation the directors regret they are unable at present to recommend the payment of a dividend on the preference shares. The improvement in the results of the company's business would have been considerably greater but for serious strikes. The supply of water from San Roque dam, while not sufficient for full requirements, was greatly in excess of that available in the two years to September, 1917, but it was necessary to operate the reserve steam plant intermittently during practically the whole of the period under review.

Prospectus.—*C. A. Vandervell & Co., Ltd.*—This company has been offering for sale £300,000 in 3,000 6½ per cent. first mortgage registered debentures £100 each at £98. The profits for the three years ended March, 1916, 1917 and 1918, were £105,604, £103,826, and £125,372. The objects of the present issue of debentures are to repay advances made by the bankers for extension purposes and to finance the increased volume of business and for developments. The list was to close on Tuesday last.

British Thomson-Houston Co., Ltd.—Annual report for 1918 shows that the profits, after deducting expenses and making provision for war taxation, were £317,016. Debenture and loan interest, £107,946. Appropriated for depreciations and reserve, £123,791. Carried forward, £150,863. The annual meeting, which was held on Wednesday, will be reported in our next issue.

Stock Exchange Notices.—The Committee has ordered the undermentioned to be officially quoted:—

General Electric Co., Ltd.—16,000 ordinary shares of £10 each, fully paid (Nos. 90,001 to 106,000).

Indian Electric Supply and Traction Co., Ltd.—11,979 shares of £1 each, fully paid (Nos. 78,022 to 90,000).

Monte Video Telephone Co., Ltd.—144,455 ordinary shares of £1 each, fully paid (Nos. 73,001 to 159,492 and 160,000 to 217,963).

Tramways (M.E.T.) Omnibus Co., Ltd.—100,000 7 per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 100,000.

Mather & Platt, Ltd.—Interim dividend of 5 per cent., less tax, on the ordinary shares for the half-year.

Montreal Light, Heat & Power Co.—Dividend of 2 per cent. for the quarter ended July 31st On the Consolidated Co.'s capital the dividend for the same quarter is 1¼ per cent.

South London Electric Supply Corporation, Ltd.—Interim dividend on ordinary shares at the rate of 4 per cent. per annum, less tax, for the June half-year.

Stewart & Lloyds, Ltd.—Interim dividends at the rate of 6 per cent. per annum on the preference and at the rate of 10 per cent. per annum on the preferred ordinary shares for the June half-year.

Chelsea Electricity Supply Co., Ltd.—Dividend of 3 per cent. per annum, less tax, on the ordinary shares for the half-year.

Chatham & District Light Railways Co.—Dividend of 8 per cent. per annum, less tax, on the ordinary shares for the half-year.

Metropolitan Electric Supply Co., Ltd.—Dividend of 2 per cent. per annum, less tax, on the ordinary shares for the half-year.

Lanarkshire Tramways Co.—Interim dividend at the rate of 7 per cent. per annum for the half-year.

South American Light & Power Co.—Dividend of 5 per cent per annum, less tax, on the ordinary shares for the half- and goodwill account £4,694, and £2,800 is carried forward.

Vickers, Ltd.—After paying interim dividends on the 5 per cent. preference stock and shares, 1s. per share, free of tax, is payable on the ordinary shares for the June half-year.

Mexborough & Rawmarsh Construction Syndicate, Ltd.—The balance to credit of profit and loss for 1918 is £5,338. After paying a dividend of 3 per cent., free of tax, £116 is carried forward.

North London Railway Co.—Interim dividend 2½ per cent. for the past half-year.

Metropolitan Railway Co.—Interim dividend at the rate of 1 per cent. per annum on the ordinary stock for the June half-year. Interim dividend on surplus land stock at 2½ per cent. per annum.

Metropolitan District Railway Co.—Interim dividends for the June half-year: 2 per cent. on the 4 per cent. guaranteed stock; 2½ per cent. on the 4½ per cent. first preference; 2½ per cent. on the 5 per cent. second preference.

London Electric Railway Co.—Interim dividends for the June half-year: 2 per cent. on the 4 per cent. preference stock; 1 per cent. on the ordinary.

Cape Asbestos Co., Ltd.—For 1918 the profit on trading, after providing for excess profits, &c., was £39,290. Dividend of 5 per cent. on preference shares; 6 per cent. on the ordinary, less tax, also on the preference an amount equivalent to the dividend on the ordinary shares, less tax, in accordance with the terms of issue, carrying forward £6,075.

Charing Cross, West End & City Electricity Supply Co., Ltd.—Interim dividend on the ordinary shares of the West End undertakings for the half-year ended June 30th, 1919, at the rate of four per cent. per annum.

City & South London Railway Co.—Interim dividends for the June half-year: 2½ per cent. on the 5 per cent. preference stocks; 1 per cent. on the consolidated ordinary stock.

Underground Electric Railways Co. of London.—Interest on the 6 per cent. first cum. income debenture stock, less tax.

Central London Railway Co.—Interim dividends for the June half-year: 2 per cent. on the undivided ordinary stock; 2 per cent. on the preferred ordinary.

Trafford Power & Light Supply (1902), Ltd.—Dividend 5 per cent. for the year. £7,500 to depreciation. £16,237 carried forward.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange market conditions continue to be of the mixed variety. There is a fair amount of business doing in some departments, although generally speaking the House is by no means over-worked. Labour continues to be a thorn in the side of confidence, and other such questions as those of the American and foreign exchanges, the price of coal, the holiday season, &c., militate against any such particular interest taken in Stock Exchange securities other than those of the all-popular oil market.

New issues are going none too well. Underwriters were so fortunate during the early part of the summer that it is something of a rude shock for them to be landed with stock now. In the course of the recent issue of English Electric 5 per cent. debenture stock we understand that the public took little more than 20 per cent., and the price of the stock has accordingly dropped to 3 discount below the starting price of 94. The latter was high, and, although the security was excellent, the issue would have been more attractive nearer the neighbourhood of 90. Underwriters of the Adelaide Electric 5 per cent. tax-free preference shares felt none too happy in regard to what they were likely to be left with, and new issues are being regarded with closer scrutiny than met them when the public were so obviously ready to rush in and buy anything some couple of months ago.

The defeat of the Government on one of the clauses of the Electricity Supply Bill aroused little interest in the Stock Exchange. It seems, in fact, to have caused more excitement amongst the politicians than in financial circles. What happens nowadays is that a holder of electric lighting shares writes to his broker and says that his holding cost him about twice as much (if not more) than the present price, and what ought he to do in the circumstances? The broker simply takes the letter into the Stock Exchange and asks one or other of the principal dealers in the shares, who are compelled to admit they do not know how to advise for the best. It is one of those cases where the outsider is the best judge of the situation. Having regard to the difficulty of selling at anything like a reasonable price, the proposition tends to resolve itself. The market continues dull and heavy, and is likely to be so until more light is thrown upon the position which may develop under the Government scheme. Considering the opposition that is gathering in regard to nationalisation of other industries, some people are already asking whether the Electricity Bill may be dropped altogether, or greatly modified. Price-changes on the week are limited to falls of 7s. 6d. in Brompton ordinary and 2s. 6d. in Metropolitans.

The award of £590,000 to the Marconi Co., as against the company's claim of £7,000,000, caused a break from 5 15-16 to 5⅜ in the price of Marconi shares. The market went wildly excited, and for a time it looked as if there might be a real slump. The seven millions, however, was never taken with any degree of seriousness in the Stock Exchange, and the actual award is held to be not so bad. Hence the appearance of the report raising the 20 per cent. dividend to 25 per cent. was followed by smart recovery to 5 15-16 in the price of the shares. The subsidiaries have moved narrowly, but on the same lines as the shares of the parent company, and Marines at 3½, Americans 31s. 6d., and Canadians at 16s. 9d. are all a little better than they were.

London Electric railway companies are doing well in the dividend declarations. On District second preference the rate is raised 1 per cent. to 2½ per cent. as compared with this time last year. On City and South London ordinary and London Electric ordinary the dividends are at the rate of 1 per cent., both showing an increase of ¼ per cent., and the same improvement characterises the 2 per cent. to be paid on Central London ordinary. The Metropolitan declares 1¾ per cent., the same as that of a year ago. The London General Omnibus dividend of 4 per cent. is also unchanged. The announcements have had no effect upon prices. Home railway stocks are out of favour, and, although there was a recovery after the coal strike had been settled, the improvement did not amount to much. Underground Electrics, however, are a better market, the income bonds coming into favour about 95 on the reinstatement of the dividend to its full 6 per cent. It may be pointed out that the coupons are payable in New York as well as in London, and at the present rate of exchange it pays handsomely to cash the dividend through an American house, the difference working out to something like half-a-crown in the £.

General Electrics show a fall of £1 to 21. They are being dealt in simultaneously as £10 shares and £1 shares. The price of the latter is called 2-2¼. As the parish magazine

says, developments are expected in this direction about September. It is interesting to notice that the International General Electric Company, which was incorporated in New York in January this year, has filed its particulars at Somerset House, the capital being 20 million dollars, divided equally into 7 per cent. cumulative preferred and common stocks. British Insulated further weakened to 2½, and British Westinghouse preference at 2 11-16 are ½ down. Other manufacturing shares are heavy, for which the reason is declared to be apprehension of labour troubles.

In the foreign group, Brazil Tractions have given way 1½ to 65, and Mexicans continue on the down grade. Bombay Electric preference have hardened to 12, and the ordinary shares are quoted 57-67. We understand that arrangements are being made for the issue of an Indian Electric Supply company before long.

Engineering and similar shares have begun to recover from the depression of last week. Babcock & Wilcox fell to 3⅜, but have rallied to 3¾. Siemens have been down to 6¼ sellers, and are now 6⅜. The cable group is fairly steady, although the frank warning of the Great Northern Co. in its recent report as to possible aerial competition in the future is still a cause for some little anxiety on the part of holders in similar undertakings. Automatic Telephones are harder at 32s. 6d. The rubber market begins to show more signs of life, and with the partial raising of the blockade against the Central Powers, a better tone is noticeable. With the oil market so much in favour, however, the general public are disinclined to bother about rubber shares. Several of the armament issues have improved, and the tone of the industrial section as a whole is certainly steadier than it has been lately.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1917.	Dividend 1918.	Price July 29, 1919.	Rise or fall.	Yield p.c.
Home Electricity Companies					
Brompton Ordinary	10	8	6½	— ½	£6 10 6
Charing Cross Ordinary	4	4	8	—	6 13 4
do. do. do. 4½ Pref.	4½	4½	8½	—	6 18 4
Chelsea	5	5	8½	—	4 16 0
City of London	5	5	11½	—	7 2 8
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
County of London	7	7	10½	—	6 13 3
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
Kensington Ordinary	7	6	5½	—	5 5 0
London Electric	Nil	Nil	1¾	—	Nil
do. do. 6 per cent. Pref.	5	6	8½	—	7 14 10
Metropolitan	4	5	2⅞	— ¼	8 13 8
do. 4½ per cent. Pref.	4½	4½	8⅛	—	7 1 2
St. James' and Pall Mall	9	10	6½	—	7 13 10
South London	5	5	2⅞	—	7 5 6
South Metropolitan Pref.	7	7	20/6	—	6 16 7
Westminster Ordinary	9	8	5¾	—	7 2 3
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	96½	—	6 4 3
do. Def.	1½	83/6	22½	—	7 8 0
Chile Telephone	8	8	6¾	—	5 18 6
Cuba Sub. Ord.	7	7	10½	— ¼	*6 13 4
Eastern Extension	8	8	12⅝	—	*5 2 3
Eastern Tel. Ord.	8	8	159½	—	*5 0 4
Globe Tel. and T. Ord.	7	8	15⅜	— ¼	*5 5 10
do. do. Pref.	6	6	10½	— ⅛	6 18 8
Great Northern Tel.	22	22	284xd	—	7 14 5
Indo-European	13	13	55	—	5 18 2
Marconi	20	25	5⅛	+ ⅛	4 4 6
Oriental Telephone Ord.	15	10	2½	—	4 9 0
United R. Plate Tel.	8	8	7¾	— ¼	*5 3 3
West India and Panama	1/3	1/3	1⅜	—	*4 11 0
Western Telegraph	8	8	16½	— ¼	*4 18 9
Home Rails.					
Central London Ord. Assented	4	4	68½	—	6 6 0
Metropolitan	1	1½	25	—	4 16 4
do. District	Nil	Nil	23½	—	Nil
Underground Electric Ordinary	Nil	Nil	8½	—	Nil
do. do. "A"	Nil	Nil	2/-	—	Nil
do. do. Income	4	5	95½	+1½	*5 4 9
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	5	+ ½	6 0 0
Anglo-Arg. Trams. First Pref.	6½	Nil	8⅛	—	—
do. do. 2nd Pref.	—	—	2¼	—	—
do. do. 5 Deb.	5	5	65	—1½	7 13 10
Brazil Tractions	—	—	64	—	—
Bombay Electric Pref.	6	6	12	+ ½	5 11 7
British Columbia Elec. Rly. Ptce.	5	5	56½	—	8 17 0
do. do. Preferred	Nil	2½	47½	—	5 5 8
do. do. Deferred	Nil	Nil	42½	—	Nil
do. do. Deb.	4½	4½	60	—1	7 1 8
Mexico Trams 5 per cent. Bonds	Nil	Nil	58½	—1	Nil
do. 6 per cent. Bonds	Nil	Nil	45½	—	Nil
Mexican Light Common	Nil	Nil	97	—	Nil
do. Pref.	Nil	Nil	80½	—	Nil
do. 1st Bonds	Nil	Nil	64½	—	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	9⅜	—	4 6 0
British Aluminium Ord.	10	10	12	—	6 8 1
British Insulated Ord.	25	12½	2⅜	— ⅛	5 17 8
British Westinghouse Pref.	7½	8	21½	— ¼	5 19 0
Callenders	25	25	9½	— ½	6 11 7
do. 6½ Pref.	5	6½	5½	—	6 3 10
Castner-Kellner	25	20	9⅜	—	7 5 6
Edison-Swan, "A"	—	—	1⅜	—	6 0 0
do. do. 5 per cent. Deb.	4	5	79½	—	6 5 9
Electric Construction	10	10	1½	—	8 18 0
Gen. Elec. Pref.	6	6½	10½	—	5 8 0
do. Ord.	10	10	21	—1	*4 15 3
Henley	25	25	9⅜	— ⅛	5 5 3
do. 4½ Pref.	4½	4½	8⅜	—	6 0 0
India-Rubber	15	15	17⅜	— ¼	*3 15 1
Siemens Ord.	—	10	6⅜	— ¼	*7 11 0
Telegraph Con	20	20	25	— ½	4 17 0

*Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Tuesday, July 29th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic .. per lb.	1/5	..
a Ammoniac Sal .. per ton	£80	..
a Ammonia, Muriate (large crystal) ..	£78	..
a Bisulphide of Carbon	..	..
a Borax	£39	..
a Copper Sulphate	£46	..
a Potash, Chlorate .. .. per lb.	1/8	..
a ,, Perchlorate	1/6	..
a Shellac .. .. .. per cwt.	£19 10	..
a Sulphate of Magnesia .. per ton	£15	..
a Sulphur, Sublimed Flowers ..	£28	..
a ,, Lump	£20	..
a Soda, Chlorate .. .. per lb.	8d.	..
a ,, Crystals .. .. per ton	£40	..
a Sodium Bichromate, casks .. per lb.	..	..
METALS, &c.		
c Brass (rolled metal 3' to 12' basis) per lb.	1/1½d.	1d. inc.
c ,, Tubes (solid drawn) .. ,,	1/5½ to 1/5½	1½d. inc.
c ,, Wire, basis .. .. .. ,,	1/2½	1d. inc.
c Copper Tubes (solid drawn) .. ,,	1/7½	1½d. inc.
g ,, Bars (best selected) .. per ton	£148	£16 inc.
g ,, Sheet .. .. .. ,,	£148	£16 inc.
g ,, Rod .. .. ,,	£144	£16 inc.
d ,, (Electrolytic) Bars .. ,,	£125	£18 inc.
d ,, ,, Sheets .. ,,	£134	..
d ,, ,, Wire Rods ,,	£138	£18 inc.
d ,, ,, H.C. Wire per lb.	1/4½	2½d. inc.
f Ebonite Rod .. .. ,,	3/-	..
,, Sheet .. .. .. ,,	2/6	..
n German Silver Wire .. .. ,,	2/6	..
h Gutta-percha, fine .. .. .. ,,	11/-	..
h India-rubber, Para fine .. .. ,,	2/5	1d. inc.
i Iron Pig (Cleveland warrants) .. per ton	Nom.	..
l ,, Wire, galv. No. 8, P.O. qual. ,,	£42	..
g Lead, English Pig .. .. .. ,,	£24 10	5/- dec.
g Mercury .. .. per bot.	£23 10	10/- to £1 in.
e Mica (in original cases) small .. per lb.	9d. to 4/6	..
e ,, ,, ,, medium ,,	5/- to 10/-	..
e ,, ,, ,, large .. ,,	12/6 to 25/- & up.	..
d Silicium Bronze Wire .. .. per lb.	1/7½	1d. inc.
r Steel, Magnet, in bars .. .. per ton	..	..
g Tin, Block (English) .. .. ,,	£265 to £266	£18 inc.
n ,, Wire, Nos. 1 to 16 .. .. per lb.	4/-	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Rivets Heated by Electric Current.—Two methods of heating rivets electrically are used quite extensively, one in which the rivet itself short-circuits the secondary of a transformer, the other in which granulated carbon short-circuits the secondary and radiates heat to the rivets. About 40 heaters of the first type are being used by the American Car and Foundry Co., these having been found very satisfactory when an air hammer is used for riveting, and especially where delays are liable to occur in fitting the material to be riveted, since power is required only when the rivets are being heated. These heaters, depending on their size, will turn out 25 lb. to 250 lb. (11 kg. to 110 kg.) of rivets per hour with a power demand of 7·5 KW. to 30 KW. and an energy consumption of 20 KW.-hours per 100 lb. (45 kg.) of rivets. The rivets can be heated in 30 seconds.

The chief advantages of the second type of heater are that the rivets can be heated uniformly and without oxidisation. The latter is important, because it avoids reduction in size of rivets and loose fits, and consequently the necessity of removing them. With one of the first heaters of the resistance-furnace type installed at the Ambridge plant of the American Bridge Co., about 200 rivets were turned out per hour at a temperature of 2,000° F. (1,100° C.) and a power demand of 40 KW. No tendency to overheat was noticed, and the presence of a reducing atmosphere prevented oxidisation and the consequent pitting and wastage of rivets. When this type of furnace is worked to capacity continuously the energy consumption is about 400 KW.-hours per ton of rivets. Including the furnace and transformer, the initial cost is about $100 per KW.—*Electrical World.*

Siemens-Schuckert Strike.—German workers continue to work as little as possible, and keep demanding higher wages but no agreement has been reached on the wages question. The Siemens works discharged 10,000 employés who threatened to strike against the advice of their leaders. The dispute is partly due to the dismissal of workmen for taking part in the strike on July 21st, which was to have been a general labour strike.

A New Electric Hand Lamp.—The *Revue Générale de l'Electricité*, June 14th, describes French patent, No. 488,665, of L. Rosengart, which comprises an electric hand lamp driven by a generator that is kept rotating by an oscillating lever actuated by the hand. The lever engages with the rotor of the generator by a ratchet. The rotor consists of a multipolar structure with poles of alternate sign, and the stator has an equal number of salient poles carrying the winding.

FOREIGN TRADE—I.

[*Suggestions from a Man who has Travelled Much.*]

The heading of this article does not in any way refer to business in electrical goods with British Colonies where legislation on matters electrical is to all intents and purposes the same as in England. In such places, and under such conditions, especially where preferential tariffs are in operation, the British manufacturer should be well able to hold his own provided he can deliver and that his prices are anywhere within reason.

We can therefore in this article leave aside the question of Colonial business and at once take up the question of business in electrical materials in countries hitherto almost entirely monopolised by the Germans, such as Spain, Portugal, Russia, the Balkans, South America and Central America.

The Germans, one may say, set the fashion in matters electrical in practically all these countries, and by establishing a large number of sales depôts, catering to the demand for cheapness, giving exceedingly advantageous terms and running a contracting side to each depôt, they succeeded in building up a very important and remunerative business.

During the war they were to a very large extent cut off from Germany, but the effect upon their business was nothing like as disastrous as many people thought would be the case, due to the fact that the Germans made a practice of never entrusting their business to an agent, but instead floated a company in the country in which they were operating, with the requisite number of more or less ornamental native directors on the board.

Companies founded in this way were empowered to manufacture, deal in, erect and operate all classes of electrical apparatus and installations, and care was invariably taken to fully protect all the designs which they were using under the local patent legislation.

This very excellent arrangement enabled the Germans in one country, which the writer knows well, to carry on during the war, and supply themselves with practically all the materials they required from local factories which they had themselves either created, financed or entered into working agreements with.

When one bears in mind that this has occurred in a country where the use of electricity is constantly extending, where raw materials are cheap, labour abundant, and, what is more, where certain classes of electrical goods are protected by what may be considered a prohibitive Customs Tariff, one is not far wide of the mark in saying that there, at least, the German electrical industry is in a considerably stronger position than it was before the war.

This state of affairs does not in any way reflect upon the inhabitants of the country under discussion—on the contrary, they are to be congratulated upon having risen to the occasion and having been able to supply practically the whole of their requirements during the war from factories established in their own country.

The said factories, irrespective of who might be their founders, can be considered in every sense of the word national industries, and are entitled to every protection as such.

At the beginning the field was an open one, and any other foreigners who had built up in that country an organisation similar to that of the Germans would in all probability have obtained results quite as satisfactory.

Financial conditions there are exceedingly favourable, the Exchange is good, and there are large numbers of keen business men at the head of the local electrical industry who will not delay in seeking a market in Central and South America and Mediterranean countries for the goods turned out in their factories. These goods cannot fail to find a ready market practically everywhere except in the United States of America and Great Britain and her Colonies, where cheap surface wiring with flexible cord is not used to any appreciable extent.

Due to the many restrictions on export business over the war period, the British electrical industry has been very severely handicapped, and even at the present moment very few firms would be justified in making extensive propaganda in foreign countries, the result being that the Dutch, American and Japanese manufacturers who have not been handicapped to any appreciable extent are doing enormous business.

Undoubtedly some of our English manufacturers intend making an effort to secure a proportion of the business to be obtained in the South American markets if the occasional advertisements in the papers are any indication of the way in which the tide is flowing, but the crux of the whole matter is: What have the majority of our British firms to offer in South America similar in type to and comparing favourably in price with American accessories, Dutch lamps, and the cheaper grades of wire and cables turned out by factories recently established in Spain?

The answer to the above question is as follows: Absolutely nothing.

At present it is a sheer waste of time and money for any British firm to put a man on the road in South America, or for that matter in any foreign country, unless the firm is ready at once to put in hand stocks of material of a type similar to what the people of the particular country are in the habit of using and at prices which compare favourably with what these people have been in the habit of paying. It is not a difficult matter to get sufficient information on types and prices and calculate the value of the market from this information, duly taking into account Customs dues, freight charges, and a reasonable profit at the other end.

This applies to practically all lines except heavy machinery.

One has heard of the smart Yankee commercial traveller who sold snow ploughs to the Government of a tropical Central American Republic, and the task of the man selling tumbler switches at eighteen pence each in a country where quite a satisfactory article is sold at sixpence is very similar.

For the purposes of this article we can divide electrical firms into two classes as follows: Class 1, those which manufacture all they handle; class 2, those which manufacture only part of what they handle.

Firms in class 1 should, in the opinion of the writer, after duly considering whether the market is worth while, float a company under the laws of the country in which they propose to work, putting one of their own staff in as manager directly responsible to them at headquarters; he should, of course, be thoroughly acquainted with the language and customs of the country, and be able to make himself a *persona grata* with the people.

As an alternative the firm could finance one of its own staff, who would register himself under local laws, and trade ostensibly under his own name.

Either of the above arrangements would be quite satisfactory, and would greatly facilitate the granting of the long credits customary in South America and would generally simplify the collection of accounts.

A well-equipped showroom is naturally essential, as is also a well got up catalogue in the language of the country, with prices of as many lines as possible

in the coinage of the country, with also, where necessary, weights and dimensions in the metric system.

Firms in the second class, and firms which manufacture only one line of goods, such as meters, would stand to lose very heavily by founding an organisation such as the above, and would get very much better results by entrusting their interests to a reliable agent, who should be, particularly in the case of meters, a technical man.

In the event of firms in class 2 entrusting their interests to a commission agent, they should assure themselves that he has suitable literature, and, in cases where technical knowledge is required, staff capable of pointing out to technical men the advantages of the lines he is offering.

Naturally considerable care must be exercised in choosing an agent of this kind. He should be of good financial standing, and he should be given every facility for granting the customary long credits.

The foregoing remarks are based on the opinions which the writer has formed as a result of a number of years' residence in various foreign countries, in the majority of which British electrical goods were conspicuous by their almost complete absence—a state of affairs which it is hoped there will be a real effort to remedy in the near future.

BREAKDOWNS OF ELECTRICAL MACHINERY.

By Dr. G. W. WORRALL.

In probably no other type of machinery are the causes of breadown so numerous as in electrical machinery. The proper knowledge of breakdowns and their causes cannot be obtained only by a study of machines returned to the shops for repair, but a full acquaintance with the conditions under which the machines operate is essential. A single breakdown may teach much, but when the same kind of breakdown is experienced many times, deductive reasoning and a comparison of conditions and circumstances will generally lead to definite and accurate conclusions. The vast majority of breakdowns have but one cause, and no exact scientific knowledge is required to understand it. Dirt, or as it has been defined, "matter in the wrong place," is responsible, and no precaution can be considered unnecessary which will prevent dirt obtaining access to the internal parts such as the commutator, armature winding, or field coils.

Damp, oil, and dirt are the greatest enemies of insulation; damp and oil are not so serious in themselves, but the danger lies in their forming a conveying medium for all kinds of injurious matter. A certain hydro-electric station was shut down for two years, the insulation resistance of the machines was practically zero, and yet without any preliminary drying they were started up and put on load; after a few weeks' service the machines had an insulation resistance of infinity. These machines have since given years of service without any breakdown. Such a case is exceptional, and is due to the fact that the atmospheric moisture was pure, and the insulation had not suffered any deterioration. The presence of damp frequently causes repairs on site to turn out very unsatisfactory. The insulating materials may be dry when taken out of the store, but by the time they are put into the machine have absorbed moisture, and the varnish is applied without stoving. A very bad example of this kind occurred in a coal mine. An underground motor of 90 H.P., 2,650-volt, three-phase, coupled to a pump, broke down to earth in the stator, and was repaired in position. The repaired coil broke down again in a week, and as the owners refused to bring the motor to the surface, the repair was again effected in the pump chamber underground. A month later the repaired coil broke down once more, and the owners then allowed the motor to be sent to the makers' works. A repair was again effected, but under favourable conditions, and no further trouble was experienced.

Where failure of insulation occurs, a green discoloration is sometimes observed near the point of breakdown, and there seems little doubt that it is in some way associated with the failure. Chemical analysis shows that where the discoloration occurs chlorine is frequently present; one possible source of which is soldering flux. Zinc chloride has been found present in considerable quantities, even in soldering paste which is guaranteed to be free from this substance. Ordinary soldering spirit is used in most shops for the purpose of cleaning the soldering iron and for tinning the conductor ends. A common practice is to dip the hot metal in the spirit, which splashes all round, and it is quite conceivable that spots reach parts of the machine which are supposed to be entirely free from such materials. The green discoloration may also be due to the vegetable and fatty acids contained in the flexible varnish with which the insulation is impregnated. It is generally admitted that some action takes place during the process of oxidation of the varnish, and even when the varnish has hardened, further action may take place, which may adversely affect the insulation which the varnish is supposed to protect.

Discoloration has been noticed more particularly in connection with built-up mica used in commutator construction, and in this case it is probably due to the methylated spirit used as a solvent of the varnish, or cement employed in the construction of the material. It is practically impossible to make a quantitative analysis of the green product as the quantity present is always too small.

A very remarkable series of breakdowns in which the green discoloration was noticed, occurred in connection with two 300-KW., D.C. generators and a 100-H.P. D.C. motor, all of which broke down in succession at short intervals in exactly the same way. The failure was in each case due to short circuits between the commutator segments at the bottom of one of the V grooves. There was no sign of any foreign matter present, but around each place where a short circuit had occurred the micanite and the copper were discoloured green. The short circuits were most likely due to the action of the solvent of the varnish on the copper, but there was also the possibility of traces of soldering spirit or even soldering paste being present. The soldering paste used was found to contain zinc chloride, and the micanite also showed traces of chlorine.

Although it is suggested that in many cases of breakdown the cause lies in the nature of the insulating materials, similar machines made of the same batch of materials at the same time do not all show the same defects. The generators and motor cited above were only three machines of a 600-KW. installation, comprising motors of 10 H.P. and upwards. The remainder of the machines proved satisfactory, and other machines turned out by the makers at the same time were free from the defect. This naturally throws some doubt on the conclusion that the fault is inherent to the materials, for the question is at once asked, why have not other machines failed in the same way? At the same time, it must be admitted that the failure of three machines in the same way is better proof that the material was faulty than the survival of the other machines was proof that the material was good. No really conclusive explana-

tion of this particular case was arrived at, but after rebuilding the commutators the trouble was not experienced again.

Producer-gas fumes have a very bad effect on insulation. More than one person who should be an authority on the subject has stated that the fumes have no bad effect on the insulation, and the only trouble is with the conducting deposit behind the commutator. The deposit which forms behind the commutator is a very fair conductor, but the effect of the gas fumes on the cotton insulation is very serious. When the armature is wound it should be dried in vacuo and thoroughly impregnated with a flexible varnish; merely painting with varnish is quite inadequate. Some makers have tried impregnating with gum, which is very effective, but in the event of repairs being necessary, the removal of a coil is a very difficult matter. Although the insulation may be perished it may hold together for a considerable time, but when one point gives way failures at many other points follow instantaneously. A 300-kw., 220-volt, d.c. dynamo was driven by an engine using producer gas. The insulation resistance of the field coils steadily diminished to a very low value; there was, however, no sign of any actual failure until suddenly all the ten coils burnt out together. The commutator of a machine subject to gas fumes becomes coated with a copper salt which is sufficiently non-conducting occasionally to prevent a dynamo exciting. Conducting deposits which lodge underneath the overhang of the armature conductors at the commutator end cause the greatest trouble where they form a leakage path between the bare copper ends of the conductors and the armature spider. Much can be done by insulating the conductors right up to the commutator lugs, and by varnishing the metal, but a more effective preventative is to increase the length of the leakage path and exclude all crevices where the deposit may lodge. The actual way in which this may be carried out depends upon the design of the machine, but generally a sheet of press-spahn is laid between the armature conductors and the supporting ring; the sheet is bent over and tied to the spider arms. In this way a smooth inclined surface is provided upon which the deposit cannot accumulate. For insulation, mica or micanite should be used wherever possible, as these materials resist the action of the fumes better than cotton.

The precautions suggested will greatly improve the running of electrical machines subject to producer-gas fumes, but the most effective precaution of all is to ventilate the engine room in such a way that the fumes do not reach the machines. There should be no opening in the wall between the producer plant and the engine room, or if an entrance is necessary the door should be opened as little as possible, and made to close automatically. The ventilation should be so arranged that the inlet of fresh air is close to the generators, so that the gas fumes do not pass over them. Most engine houses are arranged so that the main door and windows are near the generators, but they act as inlet or outlet according to the direction of the wind; a fan should always be provided to ensure that the air currents flow in the required direction. In the absence of a fan a ventilator in the roof directly over each generator is of great assistance in maintaining a good atmosphere round the machines.

The effect of chemical fumes generally is much accentuated by the presence of damp, and every precaution should be taken to keep the windings dry. When a machine is not in use, glow lamps should be kept alight inside the case, and the windings should be frequently cleaned, stoved, and varnished, if the machines are to be kept free from an abnormal number of breakdowns. Conducting deposits behind the commutator are not always due to gas fumes, but may come from the general dust in the atmosphere. d.c. turbo-generators run great risk of failure in this respect, and should whenever possible be provided with filtered air. In the power house of an iron works two 450-kw., 220-volt, d.c. turbo-generators running at 2,250 r.p.m. were run for about 12 months without being opened up for examination and cleaning; eventually the equalising connections at the back end of the armature of one machine burnt out, and a fortnight later the armature of the other machine broke down in the same way. On examination it was found that a mixture of coal and iron dust and oil had collected underneath the connections to the commutator, and had set up short circuits between the conductors. The coal dust was burnt to ash, but the insulation of the armature conductors was undamaged except where the burning had occurred. The equalising connections, however, were of much smaller section than the armature conductors, and had overheated and burnt out. It was found necessary to strip and completely rewind both armatures in order to fit new insulation at the back end. The strong draught of the generators had drawn in dust from the atmosphere, and oil from the bearings, and the mixture had not only lodged behind the commutator, but filled up the air gap solid and partly choked the outlet grids on top of the machine. After the accident air filters were fitted with very satisfactory results.

A low or high insulation resistance is not always a reliable guide to the real condition of the insulation. A machine may have a low insulation resistance, and yet the insulation may be in excellent condition. The pores of insulating media cannot be so impregnated or coated with varnish as entirely to prevent the access of moisture, and all varnish cracks and opens out after a certain time. On the other hand, if moisture be absent, and there is no actual fault, a machine may have a very high insulation resistance and yet be in very bad condition owing to real deterioration of the insulation.

The insulation used in electrical machines is of necessity for the most part of a very flimsy nature from a mechanical point of view, and although the machines may be designed so as to relieve the insulation to a very great extent of mechanical stresses, there are still stresses due principally to electromagnetic causes which seriously endanger the machine. Generally the stresses cause a slight movement when the load is suddenly changed or the current is switched on or off, and in time the movement causes abrasion of the material. This is particularly the case with field coils. In the old days the coils were wound on metal formers and the insulation was protected, but in most modern machines the coils are only taped round and wedged on the poles to prevent movement. When, however, a coil repeatedly expands and contracts, due to heating and cooling, it often becomes loose, and on switching the field current on or off the coil is moved on the pole, so that in course of time the conductor becomes earthed. If the coil is on the top of the machine considerable difficulty is sometimes experienced in detecting the fault, as when the machine is running, and cannot therefore be tested, the coil is lifted and the earth appears, while when the machine is stationary the coil is resting on the pole shoe and the earth disappears. The absence of the metal former has, of course, many advantages, but if it is discarded much stronger insulation should be used, and the coils more effectively secured. Another weak point is found at the end of the armature slots; in some makes of machine the coils are bent round too sharply, and the edges of the slot are not sufficiently insulated.

The power which a modern machine will develop is generally limited by the permissible temperature rise, and the actual temperature rise depends upon the effectiveness of the arrangements for dissipating the heat generated. The problem is of very pressing importance in high-speed turbo-generators where the radiating surfaces are of relatively small extent. There is not much difficulty in ventilating the stator,

but the rotor presents a more difficult problem. In some makes the air passages are radial, while in others they are axial. Designs are, however, continually being varied, and experience has not yet led to the general adoption of any particular method or design.

The air is forced into the rotor either by fans on the generator shaft or by an external motor-driven fan, and apart from the extra cost, the advantage seems to lie with the latter system. The higher efficiency of a properly designed motor-driven fan over the type of fan usually fitted on the generator shaft appears to compensate for the extra loss incurred in driving the motor. Many generators have fans which are very badly designed and finished, thereby seriously impairing the efficiency. In the case of an A.C. turbo-generator the rotor of which seriously overheated, the fan on the generator shaft had an outer set of blades to supply air to the stator windings, and partly ventilate the stator core, and an inner set which was intended to supply air to the rotor and through the rotor to the stator core. The effect of the rotor fan was tested by arranging baffles to cut off the action of the outer fan, and it was found that practically no air passed through the rotor. This was no doubt due to grooves which were cut in the taper portion of the rotor shaft between the fan and the rotor to conduct the air, but which apparently acted as fan blades in opposition to the fan fitted on the shaft. The result of this test was confirmed by the fact that when the generator was opened up, the rotor ventilating ducts were found to be quite free from dust, while the stator ducts were dirty. The difficulty was overcome by cutting away the fan and installing a motor-driven external fan which produced sufficient pressure to force the air through the rotor.

Wherever there is the slightest risk of dust entering a turbo-generator air filters should be fitted. Even dry dust will become hard and closely packed under the action of centrifugal force, and will fill up the ventilating ducts and interstices of the windings. The rotor of a 1,500-KW., three-phase turbo-alternator running at 3,000 R.P.M., completely burnt out due to ducts and windings being choked with cement dust. Two air filters were in use, a dry filter in a room below the turbine and directly in the main air passage, and a wet filter through which the air entered the room. All the air passed through the dry filter, but it was out of order and inefficient. The wet filter would probably have been satisfactory, but a door into the room was not sealed, and was often open, so that the wet filter was not fully in the air circuit. The whole arrangement was badly designed and of very little use. The design of fan which is fitted to motors is often very weak mechanically, the blades are badly secured and are liable to break away from their fastenings. In the case of a 100-H.P., three-phase motor, pipe ventilated, the blades came out through the air outlet, having been thrown up a vertical pipe 6 ft. long, round a right angle bend, and along a pipe several feet in length before reaching the exit. A new fan was fitted, but the same thing occurred again; after this series of accidents the fan was redesigned.

(To be concluded.)

REVIEWS.

Book-keeping and Cost Accounting for Factories. By William Kent. Pp. 260; 7 figs. London: Chapman & Hall. Price 18s. 6d. net.

The author, in his opening remarks, states that he was a bookkeeper and cost accountant before he became an engineer. A happy combination, and one that enables the author to deal with his treatise in a manner that is interesting and comprehensive to the manager, engineer, accountant or clerk engaged in manufacture or industry. Moreover, the work is "up-to-date," containing numerous illustrated forms of various manufacturing records. The size of the pages, 8¼ in. by 11 in., allows the forms to be printed without using folders. No apology is necessary in introducing this work to the electrical industry, although the author deals, *inter alia*, with printing shop costs and cost accounts for a baker; as many good ideas have been obtained from methods used in various works that are entirely different in their outputs. The author wisely deals with the elementary principles of book-keeping. Too often in books of this description elementary principles are omitted, it being taken for granted that a reader knows the A B C of the theory, whereas owing to force of circumstances, say an engineer or a chemist in a managerial capacity, may know nothing or next to nothing of the elementary principles of book-keeping, which it is essential he should know, if he wants to be an expert at costing, as book-keeping and efficient works costing are relative.

Modern methods of book-keeping are aptly described, such as the combined journal-ledger, safeguard ledger, &c., also accounts for retail merchants, selling prices, turnover. The chapter on cost accounting, cost-finding methods, and use of job tickets is very lucid, and can be easily followed by any intelligent student. The complex problems in connection with the correct allocation of burden charges are dealt with at some length, and the different methods described are interesting. That the author attaches great importance to this factor is evident by the detailed descriptions.

The chapter on depreciation deals with various methods: "Straight line," "Percentage on diminished values," "Sinking fund." Fundamentals of a cost system, statistics, cost of idleness, uses of cost, book-keeping by machinery are worth more than an ordinary glance over, and to the up-to-date man a little study will be time well spent.

Costing and book-keeping for iron works, steel works, foundries, machine shops, textile mills, &c., are described. The few pages that might interest a number of our readers most are power plant costs. The author deals with the principles of these costs, but does not give in any detail methods of costing. A very interesting table is given showing comparative cost of operation and maintenance of seven central stations; these are American undertakings, and it would have been more interesting if the author had amplified this section with more detail of American practice, such as he gives in the chapter "Costs in a printing shop," in which there are numerous illustrations of cost accounts and records. The book concludes with Chapter XXI, reports to stockholders, education of accountants, &c. This work might be termed a compendium of costing, dealing with costing in general, rather than specific instances, as in some cases the detail is given at length and in other cases detail is brief. The work is recommended to all students of scientific business management.

Can We Compete? By G. E. Mappin. Pp. x + 159 and chart. London: Skeffington & Son, Ltd. Price 4s. 6d. net.

The sub-title of this book is "Germany's Assets in Finance, Trade, Education, Consular Training, &c., and a proposed British War-Cost Reduction Programme." Mr. Mappin, who has written it, is also the author of "The Hidden (*i.e.*, German) Danger." It opens with one of Rudyard Kipling's poems, and contains a preface stating the author's knowledge of Germany, an introduction in which allegiance is professed to the economic views of the Neo-Mercantile School, fourteen chapters, and two appendices, concluding with a chart showing the relative positions of the five national interests, which are agriculture, industry, commerce, labour and general.

The fourteen chapters cover a history of economics and an exposition of the views of the author; a consideration of technical universities and commercial universities, and the desiderata for each; consular training, public schools, town-planning, policy as regards aliens; land, banking, agriculture, co-operation, and cartels. In the appendices we find a programme covering work for all; the reduction of Red-tape (with a capital R); reforms affecting the whole nation; educational reforms; the training of women; the training of apprentices; the development of fresh markets; and the reclamation of peat bogs.

And all this, says you, in a hundred-and-fifty-nine pages? Exactly. The covering of so much ground necessarily results in a scrappy and disappointing treatment of the many interesting and important subjects raised. We should have been far more inclined to consider the book to be at least an authoritative exposition of the ideas and suggestions of the school of economic thought which the author believes to be true, if he had touched upon about one-tenth of the matters which here he has failed to deal with. This is not to say that we should have agreed with him, for we detect traces of what we believe would prove to be fallacies if the author developed them along the lines on which he has started them. For example, in order to avoid the taking over of secondary education by the State, the formation of a League is advocated, which is to come into existence equipped with a monthly journal, a staff of experts, and last, but not least, funds. This League would open negotiations with the public and private schools, and the universities, to induce them to fall in line with the ways of action suggested by the experts aforesaid. "Should this scheme meet with but scant response, the League would proceed to obtain funds." We like the bland way this is announced. It would issue bonds, which apparently would sell like hot cakes. It would acquire old private schools (compulsorily, we suppose)

build new ones, and found "one or more" public schools. The whole subject of this wonderful League is dismissed in a page and a half, and the concluding sentence demolishes all arguments against State control, by stating, with perfect truth, that the primary object of all schools is to make "our boys"—why not our girls, too?—good Christians, good citizens, and efficient workers, while profit-making is a very secondary interest. The school is, in short, a public investment, and public control over all education is the right and logical method of dealing with the situation.

The training of women in land work, to enable them to emigrate, is dealt with in less than seven pages. They are not to emigrate until they are 21, and are to have two or three years' work on Government farms before they get really on to the farms they are to cultivate. All this time they meet no men, so they will be quite grown-up when they marry.

To compete with the cartels we must "create organising companies." Little more than two pages tell us how to do this. Our readers will not suspect us of any desire or intention to mock at the well-meant efforts of undoubtedly patriotic persons to make England "Wake Up" and "Think Imperially," but such superficial and incomplete treatment of national affairs as this book gives us does a minimum of good, and only makes the thinking man impatient with the author.

OXYGEN AND HYDROGEN BY ELECTROLYSIS.

In the *American Machinist* for June 28th, Mr. Ethan Viall, the managing editor, in the course of a serial on "Modern Welding and Cutting," describes various apparatus used for the production of oxygen and hydrogen by the electrolytic process.

To separate the gases a diaphragm is necessary, and on leaving the electrolyser the gases are conducted to a pressure

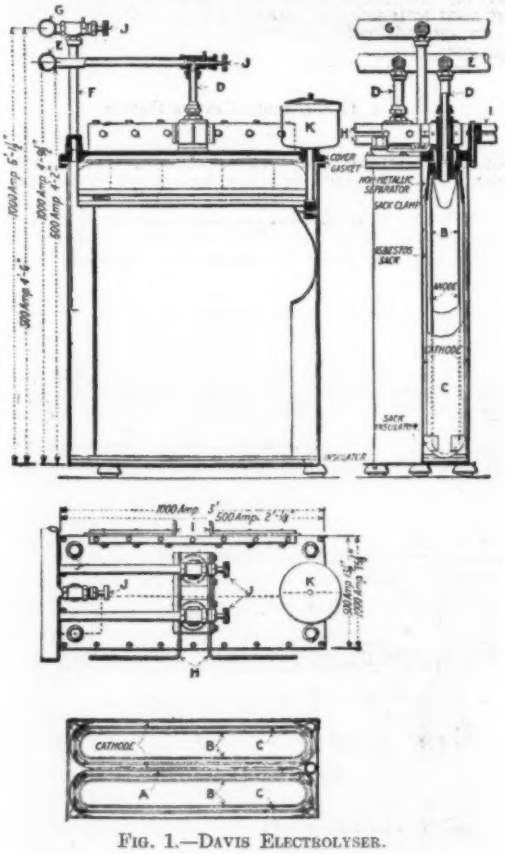


Fig. 1.—Davis Electrolyser.

regulating device which equalises the pressures on both sides of the diaphragm; they are then led to suitable gas holders. In many industrial establishments the gases are utilised as produced, being compressed and distributed by piping; the system can be made entirely automatic, so that when sufficient gas has been compressed the entire plant is shut down. But little attendance is required, and the production is under perfect control.

The Davis electrolytic cell is shown in fig. 1; these cells are made in two sizes, for 500 and 1,000 amperes respectively, producing 3.96 and 7.92 cubic ft. of oxygen and twice these amounts of hydrogen per hour. The solution is water and caustic soda or potash, and is contained in a chamber divided by the plate A, fig. 1, which forms the cathode; the anodes B are suspended on each side of the plate, and are surrounded by asbestos sacks C, which collect the oxygen and are connected by ebonite tubes D to the pipe E. The hydrogen is

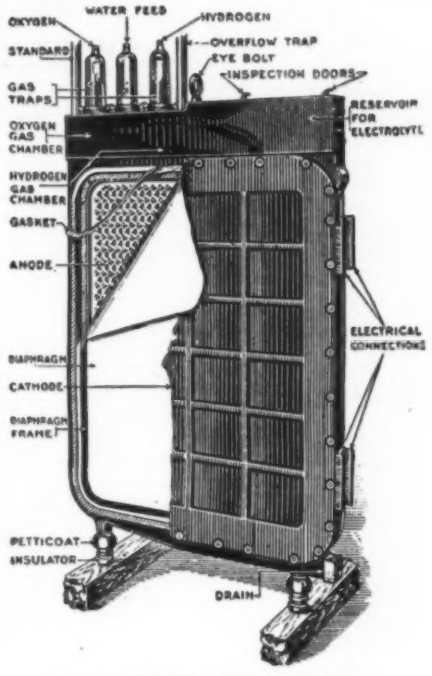


Fig. 2.—International Electrolyser.

led by tube F to the pipe G. Current is led to the anodes by the positive busbars H, and returns by the negative busbars I, which are attached to the cast-iron cover of the cell and connect it with the centre plate and the walls of the tank. Valves J are provided on the gas-pipes. As long as the pressures of the oxygen and hydrogen gases are the same, there is no tendency for the gases to mix, but if the pressures differ, one will be forced through the fabric and mix with the other; to provide against this, the gases from the pipes E and G are led through a combined flash-back and

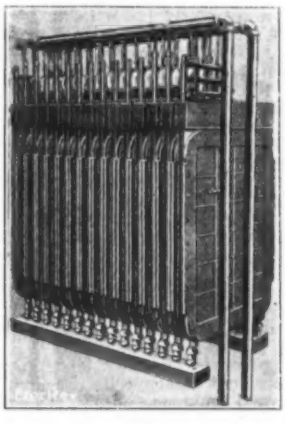


Fig. 3.—Group of International Oxygen Co's Cells.

pressure regulator. Distilled water is introduced through the reservoir K, the amount required being approximately one U.S. gallon (0.83 Imp. gal.) per 100 cu. ft. of oxygen and 200 cu. ft. of hydrogen.

The electrolytic cell shown in fig. 2 is made by the International Oxygen Co., New York. Each cell unit requires a floor space of 4 by 40 in., and with the necessary pipe connections, a head room of about 6 ft. These cells are intended to be run on a normal amperage of 600 and a voltage of 2.2 volts each, using a caustic soda solution. The current may vary between 200 and 1,000 amps., the output of gas correspondingly varying.

The cell is made up of a thin rectangular-shaped box frame, to the sides of which are bolted two cast-iron electrodes. The cavities formed between the centre and side plates are

divided by asbestos fabric diaphragms, forming two chambers. The diaphragms are clamped directly by metal and are not held in place by either rubber or cement. In the upper part of the cast-iron frame are reservoirs for the electrolyte, from which it is fed to both sides of the diaphragms. There are also two gas chambers at the top of the frame, which serve as gas traps and gas take-offs, as well as an automatic pressure-controlling device. At the bottom of the frame are communicating passages which permit the equalisation of densities in the electrolyte. The cells are constructed of material which makes them practically indestructible. Each cell is provided with an eye-bolt to facilitate handling. The electrodes are provided with a large number of pyramidal

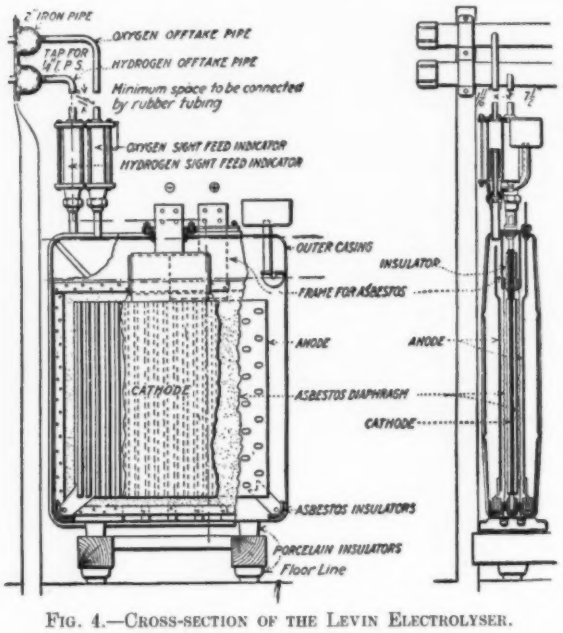


Fig. 4.—Cross-section of the Levin Electrolyser.

projections which greatly increase the area of contact with the electrolyte, and facilitate the release of the gases at the generating surfaces. At 600 amp. the production of a plant per 24 hours is 105 cu. ft. of oxygen and 210 cu. ft. of hydrogen per sq. ft. of floor space. A group of cells is shown in fig. 3.

The generator designed by I. H. Levin is of the unit type, and is made up of a few standardised parts which can be easily assembled. Details of one of the cells are shown in fig. 4, from which it will be seen that in the main the general construction is the same as that of others. One noticeable difference from those described, however, is that the electrodes are made independent of the casing, being separated from and securely fixed within the casing by specially designed blocks of asbestos.

Each compartment has an independent water feed, which also serves as a blow-off device to vent the cases under abnormal conditions. The surfaces of both the anode and cathode are plated with cobalt, which is said to lower the over-voltage or voltage in excess of what the gas electrodes require. The cells are sent out entirely welded, and completely and rigidly assembled, so that they may be filled with electrolyte, connected up, and put into service immediately. Each cell is 6¼ in. thick, 25 in. wide and 30 in. high, and weighs 185 lb. The total height is 4 ft. 8 in. Even a minimum aisle space of 30 in. will leave ample room for the removal or replacement of any cell. Each cell is intended to operate at a normal amperage of 250, requiring a little over 400 watts. A battery of 100 cells will occupy a space 4½ by 31 ft., and is claimed to produce 200 cu. ft. of oxygen and 400 cu. ft. of hydrogen per hour.

Blind Workmen.—The directors of the French Thomson-Houston Co., in the course of their annual report, drew attention to an interesting experiment which they had made at their works at Neuilly, by opening a workshop where only men blinded during the war were employed. Work carried on there for nearly a year has demonstrated in a convincing manner that many operations can be performed by these men under conditions which are perfectly satisfactory on the one hand, and, on the other, that with rates exactly equal to those in the case of normal workmen, the men soon succeed in earning an equivalent wage, and sometimes a higher wage. The hope is expressed that the experiment will become general not only in the company's works, but also in other establishments.

A PORTABLE KINEMATOGRAPH OUTFIT.

Lessons are often dull and uninteresting, and most people will agree that if lessons could be given in such a form as to be entertaining, as well as instructive, they would take deeper root. Few things teach children to be more observant, or give them more pleasure, than to be taught by means of the "pictures." History, for instance, enacted as a kinema play would be more interesting, especially as the

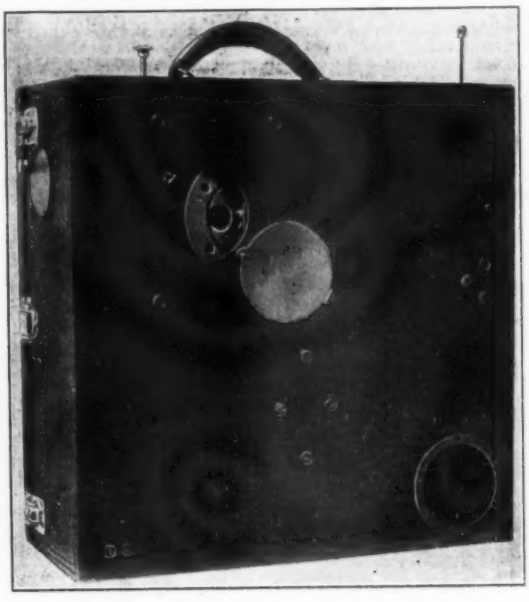


Fig. 1.—Portable Kinema Outfit.

costumes, furniture, and customs of each period could be shown. The same argument can be applied in the case of lectures. A tour through England, or anywhere else, touching all the places of interest en route, and showing them on the film, would much more likely cause the audience to remember not only where the places are, but what they look

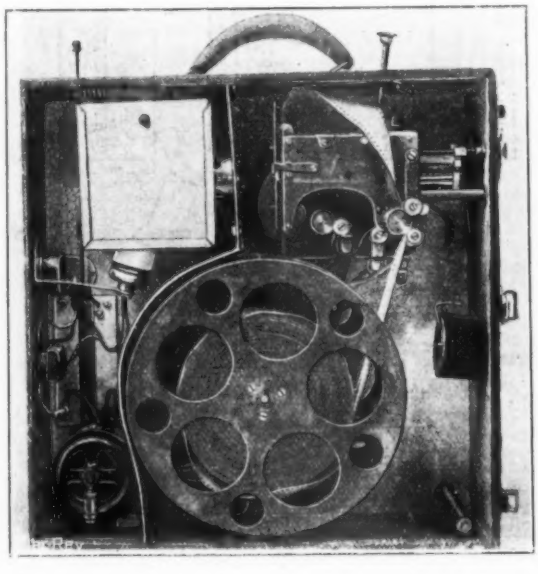


Fig. 2.—Interior, showing Mechanism.

like, which is really just as essential. The educational value of the kinema is not always appreciated. By illustrating lessons and lectures they are made more impressive, interest is maintained, and study is simplified. Again, it oftens happens in hospitals that a convalescent patient is unable to move far, and complete recovery is retarded through the lack of mental food. A portable projector would make it possible not only for the patient to entertain himself, but the whole of his ward as well.

Last week we had the pleasure of being present at a demonstration of a portable self-contained form of kinematograph apparatus which is being put on the market by, we believe, Messrs. Geo. Palmer, and which seems likely to be an extremely valuable invention for either business or pleasure. The appliance is being put forward primarily for the use of travellers and demonstrators, in order that they may display moving pictures in a buyer's office showing manufacturing process or the actual operation of the appliance they are endeavouring to sell, but the device is eminently suited to and, as indicated above, it seems to us will have just as much scope in connection with instructional as with business purposes.

The apparatus is compact and efficient; a single case contains everything necessary for showing a standard size film, wherever a supply of electricity is available. All one has to do is to place the black leather covered box, which might be a sort of glorified camera, on the table, connect it by means of an ordinary flexible cord to the nearest electric light bracket, and "press the button." Immediately a slight whirr is heard inside the box, and a perfect picture is projected on to the wall or door of the room. The great charm of the projector is its simplicity; there is no fear of anything going wrong or getting out of order. No screen is necessary, and a picture can be shown from a few inches square on the office wall to one 10 ft. square with the projector 30 ft. distant. The light, power, mechanism, and films are all self contained, giving maximum service in minimum space. Fig. 1 shows the leather covered box, the dimensions of which are 17.5 in. × 17.5 in. × 7.5 in.; it is readily portable, weighing but 20 lb., including 1,000 ft. of standard size film.

Fig. 2 shows the interior of the case; in the centre can be seen the film reels, one of which runs loose on the shaft, from which the film is unwound, passes through the projector and is then rewound on to a second reel. Standard size films of any make can be used, and the outfit will take 1,000 ft., which is sufficient to show a picture lasting about 20 minutes. A feature is that after a picture has been shown the reels can be taken out, reversed, and the film rewound ready for the next projection. This operation occupies but a short time; the two rollers shown at the bottom right-hand of fig. 2 are for straightening out the kink in the film when rewinding. The projector is situated in the top right-hand corner (fig. 2); it differs little from the ordinary machine, many of the component parts being identical; no trouble should therefore be encountered when renewals are required. Very little lens adjustment or focusing is necessary, but this can be done by means of the lever shown passing through the top of the case. Behind the projector and enclosed in a metal box is the ¼-watt lamp, and in the left-hand bottom corner the motor which drives the mechanism can be seen. The plunger projecting through the top of the case above the lamp manipulates the resistance for dimming the light when required. Attached to the motor shaft is a small fan which draws in air through the grid shown at the bottom of fig. 1; after cooling the motor the air passes up around the lamp and out at the top of the case. The motor and lamp are separated from the rest of the apparatus by a metal partition as shown in fig. 2, and the whole box is lined with asbestos, the fire risk being consequently negligible.

As previously mentioned the projector can be connected to any electric lighting bracket; normally the pressure required is 110 volts D.C., but the appliance will run equally well on A.C., and also an auxiliary resistance can be supplied if required to enable it to be run when a supply pressure above 110 volts has to be used. The cost of the complete outfit is reasonable, and its running costs, including the hire of films, is quite low. While ordinary standard size films can be used, arrangements are now being made for the supply of special films suitable for lectures and similar educational purposes. To meet the requirements of prospective users who would not be prepared to purchase an outfit outright, we would suggest that arrangements be made under which it would be possible to hire a complete outfit, including the films. Were such facilities provided we believe there is a wide and useful field of application for such an appliance, not only for business purposes but for pleasure as well.

Every manufacturer realises that one of his first objects is to secure a good salesman for the goods which he manufactures; therefore it should not need much argument to convince him that his best salesman in the future will be the silent film, which is infinitely more effective than the most eloquent salesman. In America this fact has been long realised, and American salesmen have made profitable use of it in the Far East, particularly China. It is now possible to show, in the buyer's office, not only what the finished goods look like, but the conditions under which they are made, and any other point which is likely to influence the prospective buyer in the particular article or commodity in which he is interested.

Diesel Engine Users Association.—As a result of the representations made by the Association, the Coal Mines Department of the Board of Trade has stated that it is prepared to consider applications for exemption from the operation of the Household Fuel and Lighting Order on the part of electricity undertakings using no coal for the generation of electricity.

SOUTH AMERICAN ELECTRICAL UNDERTAKINGS.

The following notes on the general operations and working results of a number of electric supply companies and other electrical concerns in South America, are extracted from more extended particulars given in the *Review of the River Plate*:—

Compania Argentina de Electricidad, S.A.—As in recent years, there having been no improvement in the economic situation in general, only such works have been carried out in the installations of the company as were indispensable to enable it to comply with its undertakings in virtue of its concession contracts. A commencement was made during the year with work preliminary to the erection, on land which the company possesses at San Isidro, of the main transformer sub-station, main workshops and stores, hitherto situated in premises rented for the purpose. The year closes with a loss of $79,865·98 m/n. Added to the loss sustained in 1917, the loss at December 31st last amounted to $114,657·94 m/n.

Compania Industrial de Electricidad.—Due to difficulties of a technical nature, the production of steel castings only became normal in the middle of the year; it has now entered a period of profitable activity. The Compania Americana de Luz y Traccion has recently acquired the concessions and installations for the production of electric current and relating to electric tramways in Asuncion, Paraguay, the working of which produces gratifying results. The profit for the past year, including $2,289·40 gold brought in, was $91,498·42 gold. The reserve and amortisation funds amount to 78 per cent. of the share capital.

Compania Italo-Argentina de Electricidad.—The past year has been characterised by notable development—*i.e.*, an increase of 62·15 per cent. in energy generated. Total output in 1917, 31,345,363 KW.-hours; in 1918, 50,827,658 KW.-hours. In spite of the increase in the production of energy, the company was able to withstand the grave fuel crisis and to maintain its services. The installations carried out were fewer than in previous years; they comprised principally installations intended to cope with the increasing demand for energy in the central zone, and especially in the southern part of the city. The work of augmenting the generating capacity at the principal power house, commenced during the period under survey, is very well advanced, but it was not possible to complete it during the year; it may be so this year. There is about to be put into service a new turbine-generator of 12,500 K.V.A., the largest in the country. The increase in the numbers of customers has continued. The gross profits for the year amounted to $954,480. The Board proposed a dividend of $6 m/n per share—or, say, $300,000.

At the principal ("Pedro Mendoza") power house, in May, 1918, a new pumping and boiler plant were brought into service, and in September the enlargement of the building, so as to accommodate four more boilers, was started.

In the last quarter of 1918 the two new steam generators and their accessories, economisers, and chimney, were delivered.

In the beginning of that year there were erected, in the principal power house, several installations for the manipulation, transport, and automatic loading of certain low grade, fine ground, fuels, which were used throughout the year in large quantities, by means of a special system of intensive combustion, in order to make good, as adequately as possible, the scarcity of ordinary fuel. The new turbo-alternator of 12,500 K.V.A. was nearly ready for working at the end of the year. The delay in dispatching from Europe the requisite steam piping—received only at the end of January of this year—retarded the installation of this powerful unit. In regard to secondary generating stations and transforming sub-stations during the year, two converters were installed, each of 1,000 KW., one at the "Balcarce" sub-station, and the other at the "Moreno" sub-station.

Two units, each of 500 KW., were withdrawn from the "Tres Sargentos" sub-station, and the "Moreno" sub-station respectively. The construction of three new units each of 1,000 KW. was put in hand for installation in 1919. When the new units are installed the total plant for the supply of direct current will be:—

	KW.
13 Diesel generator groups with a total capacity of ...	6,500
21 converter groups with a total capacity of	19,500
	26,000

The number of static transformer sub-stations was notably augmented. At the end of 1917 there were 17 sub-stations in existence, with transformers of 3.040 K.V.A.; at the end of 1918 there were 36 sub-stations having 8,495 K.V.A. capacity.

In the middle of 1918 the contract of 1915 relative to supply of electric light to the port of the capital was modified, all the arc lamps being changed for metallic-filment lamps; by this means it was possible to improve the service, and the company was relieved of the grave technical and economic difficulties occasioned by the lack of suitable carbons for arc lamps. The total number of connections in active service at the end of 1918 amounted to about 24,000, showing an increase of 5,000 over the year 1917, or approximately 26 per cent. This increase in connected installations represents altogether an installed load of over 16,000 KW. The high average of installed load per unit is explained by the fact that it has to serve some very powerful installations. During 1918 the following (amongst other) connections were made:—Gath & Chaves, Ltd., Harrod's, Ltd., Tienda "A la Ciudad de Mexico," Fabrica Argentina de Alpargatas, Franco-Argentina

establishment, Marine Arsenal, Central Argentine Railway. The increase in number of customers was again very important, notwithstanding that the company had limited its action to intensifying the working of the central and southern zones of the city, not extending it to other districts. The services rose from 23,000 contracted for at 1917 to 28,000 at 1918, and installed load rose from 52,000 to 63,000 KW.

ENERGY GENERATED.

	K.W.H.
By turbo-alternators (H.T., three-phase, 50 periods) ..	40,549,400
By Diesel-dynamo sets (L.T., D.C., for general service and traction)	10,278,258
Total	50,827,658

ENERGY CONVERTED AND TRANSFORMED.

	K.W.H.
By rotary converters to D.C. (for general service and traction	24,166,042
By static transformers to three-phase current (50 periods, low-tension)	7,876,000
Total	32,042,042

Energy distributed to the cables from power houses, sub-power houses and sub-stations, in the form supplied to clients (the company's own consumption being deducted in each case).

	K.W.H.
General Service—	
D.C.	30,190,696
Three-phase alternating current:	
L.T.	7,876,000
H.T.	4,419,611
Total	42,486,307
Traction Service—	
D.C.	3,655,693
Grand Total	36,142,000

NEW PATENTS APPLIED FOR, 1919.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS SEPTON-JONES, O'DELL AND STEPHENS (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

17,583. "Radiating antenna systems." BRITISH THOMSON-HOUSTON Co. (General Electric Co.) July 14th.

17,596. "Reactance coils." C. TURNBULL. July 14th.

17,601. "Electric apparatus for prevention of corrosion in steam boilers, &c." A. S. GUSH. July 14th.

17,603. "Plates for electric accumulators." H. DE MARTIS and UNIVERSAL ACCUMULATORS CO., LTD. July 14th.

17,620. "Electro-plating process and attachment." A. G. SNELL. July 14th.

17,622. "Sparking plugs for internal combustion engines." C. M. E. L. MONNIER. July 14th. (France, July 13th, 1918.)

17,637. "Electrical heaters." J. R. QUAIN. July 14th.

17,639. "Electric cut-outs." E. A. PETITHORY and SIEMENS BROS. & Co. July 14th.

17,640. "Selecting devices for automatic telephone systems." E. A. PETITHORY, SIEMENS BROS. and G. P. SUMNER. July 14th.

17,641. "Selecting devices for automatic telephone systems." SIEMENS BROS. & Co., G. P. SUMNER and D. A. CHRISTIAN. July 14th.

17,669. "Electrical fuse carrier." G. BRERETON. July 15th.

17,686. "Manufacture of metallic filaments. BRITISH THOMSON-HOUSTON Co. (General Electric Co.) July 15th.

17,701. "Electric radiators, &c." ENGLISH ELECTRIC Co. and R. WEAVING. July 15th.

17,726. "Electrical starting set for automobile engines. A. H. PYNE. July 15th.

17,764. "Illumination device for use with trolley poles of electrically-propelled vehicles. L. H. DAVIS. July 16th.

17,774. "Means for timing or setting valves and ignition of internal-combustion engines, &c." E. J. KYNOCH. July 16th.

17,787. "Safety transformers for low current coils." A. PEREGO. July 16th.

17,790. "Impulse-transmitting devices for automatic or semi-omatic telephone systems." AUTOMATIC TELEPHONE MANUFACTURING CO. July 16th. (United States, September 13th, 1918.)

17,800. "Electric starting appliances for internal-combustion engines." A. A. Price. July 16th.

17,803. "Electrode holder for electric arc welding and depositing metals." ALLOY WELDING PROCESSES, LTD., and H. B. SAYERS. July 16th.

17,813. "Thermostatic regulators." BRITISH THOMSON-HOUSTON Co. (General Electric Co.) July 16th.

17,814. "Sparking plugs." P. A. ALLEN. July 16th.

17,821. "Heating material or performing chemical processes in electrical furnaces." AKTIEBOLAGET KVAFVEINDUSTRI. July 16th. (Sweden, April 12th.)

17,869. "Telephone, &c., systems." W. P. THOMPSON. (Compagnie Generale de Radiotelegraphie.) July 17th.

17,870. "Electrical low-tension oil switches." R. T. NORTON. July 17th.

17,888. "Appliance for operating magneto-ignition apparatus of automobile internal-combustion engines." H. W. BAMBER. July 17th.

17,893-4. "Switching apparatus for selecting and operating sets of electrical contacts." G. A. BETULANDER. July 17th. (Sweden, April 2nd.)

17,895. "Circuit arrangements for telephone plants." G. A. BETULANDER. July 17th. (Sweden, April 2nd.)

17,896. "Electromagnetic switching apparatus." G. A. BETULANDER. July 17th. (Sweden, April 17th.)

17,902. "Electric arc furnaces." BRITISH THOMSON-HOUSTON Co. and H. C. HASTINGS. July 17th.

17,917. "Device for locking electric lamps." M. ARCHER and J. BEIN. July 17th.

17,944. "Apparatus for reducing strength of electric current." W. J. HUGHES. July 18th.

17,968. "Electric storage, &c., batteries." E. W. CLARKE and LONDON BATTERY Co. July 18th.

17,974. "Telephone leads, &c., for kite balloons, &c." O. S. STILES. July 18th.

17,987. "X-ray tube shields." BRITISH THOMSON-HOUSTON Co. (General Electric Co.) July 18th.

17,988. "Electric furnace control apparatus." H. A. WINNE. July 18th.

18,001. "Magnetos." J. H. RUNBAKEN and W. TORRANCE. July 18th.

18,003. "Electric boiler." E. PIGUERET. July 18th. (Switzerland, October 4th, 1918.)

18,004. "Electric furnace." E. PIGUERET. July 18th. (Switzerland, September 2nd, 1918.)

18,005. "Sparking plug for internal-combustion engines." E. PIGUERET. July 18th. (Switzerland, December 18th, 1918.)

18,006. "Resistance for electric furnaces." E. PIGUERET. July 18th. (Switzerland, February 20th.)

18,016. "Electric furnaces." ELECTRO METALS, LTD., and T. D. ROBERTSON. July 18th.

18,027. "Apparatus for converting direct current into high-frequency alternating current." A. W. DALE. July 18th.

18,034. "Telephone transmitter" J. S. TIMMONS. July 18th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

2,639. ELECTRICAL SIGNALLING OR INDICATING APPARATUS ESPECIALLY APPLICABLE FOR SIGNALLING ORDERS OR NUMERICAL DATA. E. A. Graham. August 4th, 1916. (Divided application on 11,052/16.) (128,594.)

11,154. ELECTRIC BATTERIES. G. N. Antonoff. August 2nd, 1917. (128,600.)

11,217. ELECTRIC ARC LAMPS WITH ROTARY ARCS. L. Mauclaire, A. Garbarini and G. Gautier. August 3rd, 1917. (128,606.)

11,360. ALTERNATING CURRENT GENERATOR OR ROTARY CONVERTER GROUP. Soc. Française Radio-Electrique. August 4th, 1916. (128,614.)

11,389. LAMPS OR LANTERNS FOR AEROPLANE FLYING MACHINES AND OTHER AIRCRAFT. Fuller Accumulator Co. and H. C. Brown. August 8th, 1916. (Cognate application 1,321/18.) (128,615.)

11,658. APPARATUS FOR THE CONCENTRATION OF ELECTRIC WAVES IN A SINGLE DIRECTION OR UPON A FIXED POINT. L. Rota and E. Binetti. August 14th, 1917. (128,624.)

12,077. DIRECT CURRENT ELECTRIC MOTORS. J. Y. Johnson. (F.I.A.T., Fabbrica Italiana Automobili Torino Soc. Anon.) August 22nd, 1917. (128,648.)

12,441. REFLECTORS FOR USE IN WIRELESS TELEGRAPHY AND TELEPHONY. Marconi's Wireless Telegraph Co. (G. Marconi.) August 29th, 1917. (128,665.)

12,539. METHOD OF GENERATING IGNITION CURRENTS FOR INTERNAL COMBUSTION ENGINES AND APPARATUS THEREFOR. Splitdorf Electrical Co. August 31st, 1916. (128,672.)

12,577. RECEIVERS FOR WIRELESS SIGNALS. Marconi's Wireless Telegraph Co. and C. S. Franklin. September 1st, 1917. (128,673.)

15,629. APPARATUS FOR ELECTROLYTIC PRODUCTION OF ZINC, COPPER AND OTHER METALS. Soc. de Metallurgie Electrolytique. October 28th, 1916. (128,676.)

1918.

1,757. WIRELESS SIGNALLING SYSTEMS. British Thomson-Houston Co. (General Electric Co.) January 30th, 1918. (128,682.)

7,517. MAGNETO GENERATORS. W. Phillips and Elliott Bros. May 4th, 1918. (128,689.)

8,505. ELECTRIC LAMP-HOLDERS. A. H. Short. May 22nd, 1918. (Addition to 102,111.) (128,697.)

10,480. SPARKING PLUGS FOR INTERNAL COMBUSTION ENGINES. G. [illegible] Aveline and F. Souaille. June 25th, 1918. (128,727.)

10,550. DEVICE FOR SECURING LIQUID TIGHT PASSAGE FOR [illegible] CONNECTIONS OF ELECTRIC ACCUMULATORS FOR CONTAINERS MADE OF CELLULOID. A. Dinin. June 25th, 1917. (118,092.)

10,626. DYNAMO ELECTRIC MACHINES. Vickers, Ltd., and S. F. Barclay. June 27th, 1918. (128,739.)

10,809. SPARKING PLUGS. W. S. Thomas. June 29th, 1917. (118,093.)

12,725. ELECTRIC CABLE CONDUIT FITTINGS. J. MacDougall and W. H. Beresford. August 6th, 1918. (128,786.)

12,765. DYNAMOS FOR THE PRODUCTION OF UNIFORM CONTINUOUS CURRENT. Evershed & Vignoles and W. Clark. August 6th, 1918. (128,787.)

12,963. AUTOMATIC REGULATORS FOR DYNAMO ELECTRIC MACHINES. British Thomson-Houston Co. (General Electric Co.) August 9th, 1918. (128,790.)

13,767. ELECTRICAL RELAYS. C. B. Harlow. August 28th, 1917. (120,376.)

15,375. TELEPHONE SWITCH APPARATUS. Automatic Telephone Manufacturing Co., J. Savin and R. R. Wade. September 21st, 1918. (128,809.)

18,468. ELECTRIC CIRCUITS INSTANTANEOUSLY SENSITIVE TO PHOTO-ELECTRIC ACTION. F. Tavini. November 11th, 1918. (128,831.)

19,957. SPARKING PLUGS FOR INTERNAL COMBUSTION ENGINES. W. Suckling, J. Suckling and B. Carter. December 3rd, 1918. (128,842.)

1919.

5,464. DYNAMO ELECTRIC MACHINES. J. L. Burnham. March 6th, 1918. (124,207.)

7,862. REGULATING DEVICE FOR MAINTAINING A CONSTANT VOLTAGE OR INTENSITY IN DYNAMOS WORKING WITH GREAT VARIATIONS OF OUTPUT. L. Rouzet. March 28th, 1919. (128,885.)

11,436. ELECTROLYTIC GAS GENERATORS. I. H. Levin. May 22nd, 1917. (Divided application on 8,207/18.) (126,640.)

British Scientific Products Exhibition.—The King and Queen, accompanied by Prince Henry and Princess Mary, and attended by Captain Sir Bryan Godfrey-Faussett and Countess Fortescue, visited the Central Hall, Westminster, on Tuesday afternoon last week, to make an inspection of the Exhibition. The Royal visitors were received by the Marquis of Crewe, Sir Richard Gregory (chairman of the Exhibition Committee), Sir Robert Hadfield, and Mr. A. A. Campbell Swinton (members of the Committee), with Mr. F. S. Spiers (organising secretary). Their Majesties made their inspection in great detail, and displayed marked interest in all that they saw. The Duke of Connaught, accompanied by the Crown Prince of Sweden, visited the Exhibition on Wednesday last week.